PART II

CHAPTERS FOR THE USFWS

Chapter 4 AQUATIC SNAILS

4.1 Status

Five species of aquatic mollusks in the middle Snake River were listed as endangered or threatened in 1992 (57 FR 59244). The Banbury Springs lanx (*Lanx* sp.), the Idaho springsnail (*Pyrgulopsis idahoensis*), the Snake River physa (*Physa natricina*), and the Utah valvata (*Valvata utahensis*) were listed as endangered. The Bliss Rapids snail (*Taylorconcha serpenticola*) was listed as threatened. The *Federal Register* notice provided summary information for the species. All five species are endemic to the Snake River and/or some springs and tributaries, and all are thought to be generally intolerant of pollution. These species were listed due to declining distribution within the Snake River, adverse habitat modification and deteriorating water quality from hydroelectric development, peak-loading effects from water and power operations, water withdrawal and storage, water pollution, and inadequate government regulatory mechanisms. However, studies conducted since the listing show that the Bliss Rapids and Idaho springsnail are significantly more widespread than described in 1992 (Cazier 2001a, 2001b, 2001c, 2002), and actually may fully occupy the described historical distribution of the species.

The USFWS (1995) recovery plan for these species includes short- and long-term multi-agency objectives to restore viable, self-reproducing colonies of the listed snails. Downlisting or delisting will depend on the detection of increasing, self-reproducing colonies at monitoring sites within each species' recovery area for at least a 5-year period. The recovery area for these species extends from American Falls Dam (RM 709) downstream to C.J. Strike Reservoir (RM 518) (USFWS 1995). It should be noted that the State of Idaho, in conjunction with Idaho Power, formally petitioned the USFWS in the fall of 2004 to delist the Idaho springsnail.

As described in Appendix A, the proposed actions will have no effect on the Banbury Springs lanx or habitat important to its survival; this chapter does not discuss the Banbury Springs lanx further.

4.1.1 Previous Consultations

The 1999 USFWS biological opinion for Reclamation's O&M activities in the upper Snake River basin concluded that the normal operations and maintenance of the Reclamation facilities and the delivery of salmon flow augmentation may affect, but is not likely to adversely affect, the Bliss Rapids and Utah valvata snails; will have an unknown affect on the Snake River physa; and will have an undetermined effect on the Idaho springsnail. The opinion concluded that the proposed action will not jeopardize the continued existence of the listed snail species. The required terms and conditions and the current status of Reclamation activities related to these conditions are:

1. Meet with the USFWS to determine the delivery of salmon augmentation water. Reclamation has coordinated the delivery of salmon augmentation water with the USFWS, NOAA Fisheries, and other agencies.
2. Meet with the USFWS to develop an overall monitoring strategy. Reclamation and the USFWS agreed on a field and laboratory research and monitoring plan that is currently underway (Wood et al. 2000). Laboratory tolerance studies and field measurements executed as part of this plan are summarized in several reports (Lysne 2003a; Weigel 2002, 2003).
3. Meet with the USFWS to determine ramping rates for the salmon augmentation water releases. Reclamation applied the agreed 100 to 200 cfs per day downramping rate of salmon augmentation water releases during periods when salmon augmentation water was released upstream from Milner Dam.
4. Identify and track other agencies' water quality monitoring actions. Reclamation water quality staff is involved in coordinating water quality monitoring and the total maximum daily load (TMDL) process.
5. Consult with the USFWS on the design and implementation of snail shell surveys. Reclamation conducted shell surveys in American Falls Reservoir and downstream reaches to Jackson Bridge. These data have not revealed a relationship between shells and live individuals. Therefore, Reclamation and the USFWS have agreed to focus efforts on detecting live individuals.
6. Perform additional analysis in Lake Walcott to determine if water quality is adequate for the persistence of Utah valvata. The analysis of the 1997 Lake Walcott data indicates that most of the Utah valvata in Lake Walcott are dependent on flows from the Snake River for water quality (Irizarry 1999). Water quality monitoring indicates that Lake Walcott supports cold water biota in most years.

4.2 Distribution

4.2.1 Historical Distribution

Historical distributions of the four species of snails are based on fossil records collected as early as 1880 (USFWS 1995). The distribution of these species ranged from Utah Lake near Lehi, Utah, west to Homedale, Idaho. Based on the fossil record, the snail species are endemic to the Pliocene Lake Idaho region and its

Pleistocene successors (Frest 1991). The fossil record shows larger than current distribution, with historical populations considered to be continuous throughout their range. Snake River physa were collected live from the mainstem Snake River between Grandview and Hagerman, Idaho, from 1956 to 1985 (Taylor 1988) and from below Minidoka Dam in 1987 (Pentac 1991). Utah valvata was documented as one of the most abundant species of mollusks in the Snake River and Box Canyon Creek during surveys conducted in the 1960s and 1980s (Bowler and Frest 1992).

4.2.2 Current Distribution

The current distribution of the four species is restricted to the Snake River basin, Idaho, from the lower Henrys Fork (RM 9.3) downstream to the Snake River, and from the Snake River (RM 837.4) downstream to Brownlee Reservoir (near RM 345) near Weiser. Table 4-1 presents a summary of recent locations for the snail species, and Figure 4-1 (see page 58) displays these locations.

Table 4-1. Summary of locations and data sources for listed snails found during recent surveys.

Snake River Mile	Entity	Year	Location [1]	Species
365-370	Idaho Power	1997, 1998	M	Idaho Springsnail
392-460	Idaho Power	1997, 1998	M	Idaho Springsnail
468	Idaho Power	1997, 1998	M	Idaho Springsnail
473-495	Idaho Power	1997, 1998	M	Idaho Springsnail
495-496	Idaho Power	1997, 1998	R	Idaho Springsnail
Bruneau Arm 3.8	Idaho Power	1997, 1998	R	Idaho Springsnail
545-560	Idaho Power	1992	M	Bliss Rapids Snail
551-553	Idaho Power	2000	M	Idaho Springsnail
555	Idaho Power	1995	M	Snake River Physa (suspected)
565-573	Idaho Power	2000	M, S	Bliss Rapids Snail
571	Idaho Power	1996	M	Snake River Physa (suspected)
570-571	Idaho Power	2001	M	Idaho Springsnail (suspected)
584-590	Idaho Power	1992-2000	M, S	Utah Valvata
671	Pentac, Reclamation	1987, 1995	M	Snake River Physa
669-675	Reclamation	1996, 1997	M	Utah Valvata
677-700	Reclamation	1997	M	Utah Valvata
706	Reclamation	1996	M	Utah Valvata
708	Reclamation	1996	M	Utah Valvata
714	Reclamation	1998	R	Utah Valvata
777	USFWS	2003	M	Utah Valvata
Henrys Fork 9.3	Montana State University	2004	M	Utah Valvata

1 Location designations are for Mainstem, Reservoir, and Shoreline.

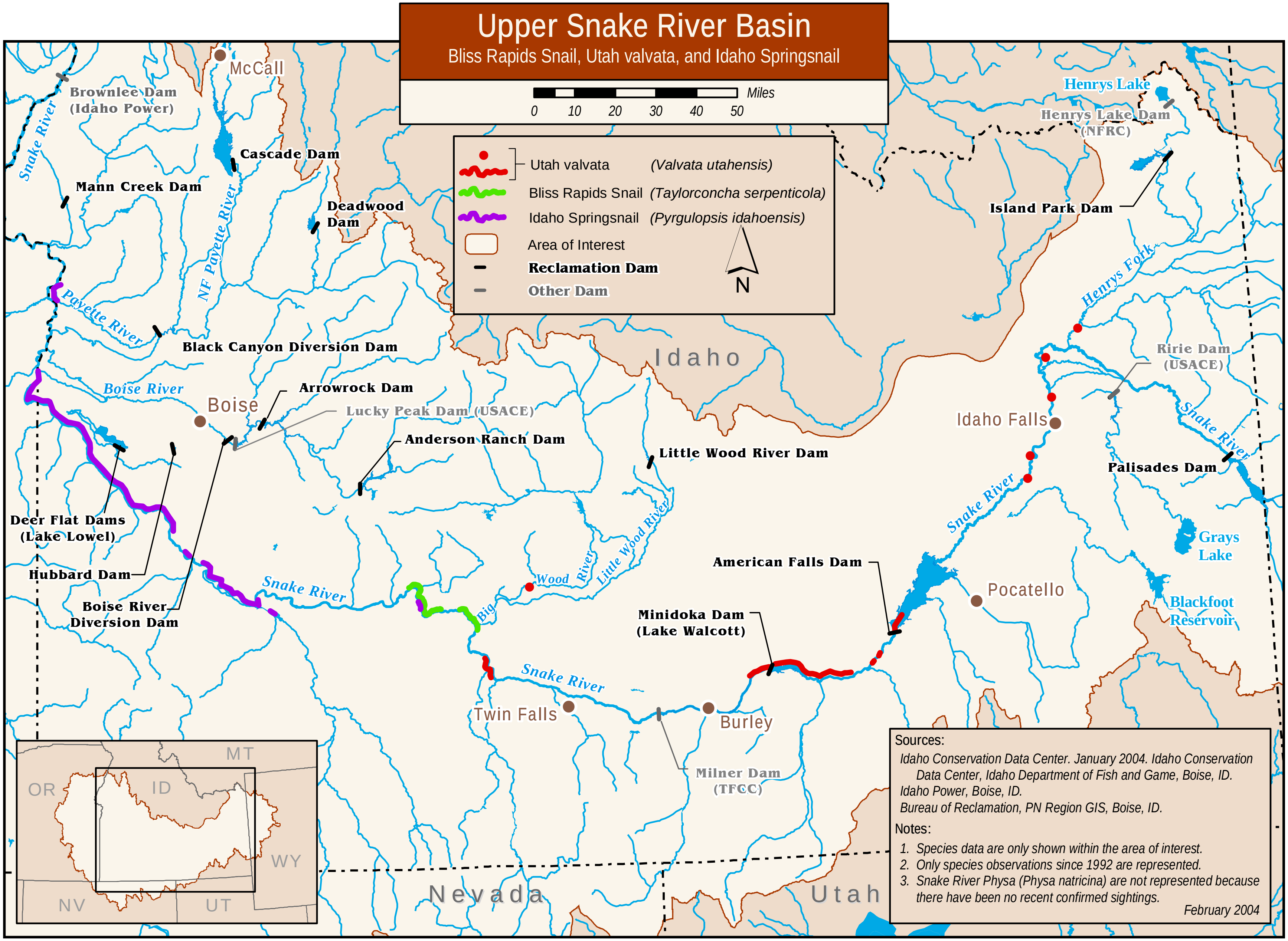

Figure 4-1. The distribution of the four ESA-listed snails in the Snake River and Henrys Fork.

Utah Valvata

The Utah valvata has a discontinuous distribution ranging from Hagerman (near RM 572) upstream to the lower Henrys Fork (RM 9.3, near the Snake River mile 837.4). Below Milner Dam (RM 639.1), this species is present in the Box Canyon (RM 588.2) and Thousand Springs (RM 585) areas, Niagara Springs (RM 599), and Upper Salmon Falls Reservoir (RM 580). Surveys during the early 1990s found average population densities of 0.25 snails per m^2 in two colonies (Frest and Johannes 1992). A colony also exists in the Big Wood River near Gooding, Idaho. The extent of the distribution of Utah valvata in the Big Wood River is unknown, but shells have been found in areas of Magic Reservoir (Lysne 2003b).

Snake River Physa

Live verified specimens of the Snake River physa have not been collected during invertebrate surveys conducted on the Snake River during the last 10 years; however, there were two unverified suspected sightings near Bliss, Idaho (Stephensen and Cazier 1999). In addition, Keebaugh (2004) at the Orma J. Smith Museum of Natural History recently discovered 4 Snake River physa (alive when sampled) and 12 empty Snake River physa shells. The Orma J. Smith Museum of Natural History, located at Albertsons College in Caldwell, Idaho, is the Federal depository for Federal Snake River snail collections. Reclamation consultants collected the potential Snake River physa specimens during samplings in 1996 below Minidoka Dam (see Table 4-2 on page 60). The identification of the specimens has not been verified; therefore, their taxonomic classification is contingent upon a final verification by the appropriate authorities.

Bliss Rapids Snail

The Bliss Rapids snail has a discontinuous distribution and is found in the tailwaters of Bliss and Lower Salmon Falls Dams, Thousand Springs, Banbury Springs, Box Canyon Springs, and Niagara Springs (USFWS 1995; Cazier 1997, 2001a, 2001b). It is most abundant in springs and tributaries from Clover Creek to Twin Falls but is found in scattered colonies along the Snake River, most associated with springs or tributaries. This species is not found in pools or reservoir habitats.

Idaho Springsnail

The Idaho springsnail ranges from upper Brownlee Reservoir (RM 345) upstream to Bancroft Springs (RM 553) near Bliss, Idaho, and is found in high densities in shoreline habitat along portions of C.J. Strike Reservoir (Cazier et al. 2000; Cazier 2001a, 2001b, 2001c) (see Figure 4-1 on page 57).

Table 4-2. Summary of Orma J. Smith Museum of Natural History potential Snake River physa holdings as of June 22, 2004.

Museum Accession #	Survey Date	Survey Site	River Mile	Latitude/Longitude	Status	Quantity
28830	27 Aug 1996	Site A9/V2	670.9	42°39’17.51”N, 113°33’21.68”W	Live	1
28926	28 Aug 1996	Site C9	672.7	42°39’49.80”N, 113°31’31.01”W	Live	1
45349	29 Aug 1996	Site D1	673.1	Lost	Live	1
28968	29 Aug 1996	Site E2	674.2	42°40’23.99”N, 113°29’54.61”W	Live	1
30200	26 Aug 1996	Site E3	674.6	42°40’28.08”N, 113°29’27.93”W	Empty	1
41524	23 Oct 1997	Zone 1, Site A-3	670.4	42°39’15.71”N, 113°33’50.24”W	Empty	1
41426	22 Oct 1997	Zone 1, Site A-3	669.6	42°38’43.77”N, 113°34’37.09”W	Empty	1
45282	27 Aug 1996	Site A10/V1	671.0	42°39’20.00”N, 113°33’16.06”W	Empty	1
41408	22 Oct 1997	Zone 1a, Site A-1	669.2	42°38’25.76”N, 113°34’53.39”W	Empty	1
30656	13 Nov 1995	Site 1A, Grid B,0	667.3	42°39’03.53”N, 113°33’55.15”W	Empty	1
41477	22 Oct 1997	Zone 1a, Site A-14	669.7	42°38’40.71”N, 113°34’23.23”W	Empty	1
31592	13 Nov 1995	Site 1A, Grid E,0	667.3	42°39’03.53”N, 113°33’55.15”W	Empty	2
30681	13 Nov 1995	Site 1A, Grid J,3	667.3	42°39’03.53”N, 113°33’55.15”W	Empty	1
41515	22 Oct 1997	Zone 1A, Site A-12	669.1	42°38’16.75”N, 113°34’43.86”W	Empty	1
28797	27 Aug 1996	Site A2	670.4	42°39’14.16”N, 113°33’56.97”W	Empty	4

4.3 Life History

Utah valvata have a turbanate shell that typically reaches a maximum diameter of 6 to 7 mm. The snail is thought to be univoltine (1 year life cycle) with a reproductive period in the spring and/or fall. The Utah valvata is hermaphroditic (individuals have both male and female sex organs), but it is unknown whether it will self-fertilize. Utah valvata are between 2.5 and 3.5 mm in size during their first reproduction, and they deposit egg masses on hard surfaces that have 3 to 12 eggs per sac. The egg masses are up to 1.5 mm in diameter. Egg masses have been observed between April and November (peak in June and July) in laboratory aquaria (Lysne 2003a). After hatching, the emergent Utah valvata are 0.7 mm in size (Lysne 2003a).

The Snake River physa reaches a height of 5 to 7 mm and has an elongate shell with compressed whorls at the top. The snail is hermaphroditic. Few Snake River physa have been collected live, so little is known about their life history.

Adult Bliss Rapids snails are up to 3.0 mm in size with conical shells. Most information on the life history of this snail has been collected in laboratory aquaria and in Banbury Springs. The Bliss Rapids snail is 2.3 to 3.0 mm in size during their first reproduction, and they deposit egg masses on cobbles. The egg sacs contain 5 to 15 eggs. The snails reproduce during summer and early autumn in the Snake River, and early summer in Banbury Springs (Richards 2004). Seasonal die off occurs from October to December (Cazier 1997). Bliss Rapids snails inhabit all of the conventional river habitats (main river, edgewater, springs, and swiftwater zones); however, association with springs or spring-influenced areas in the mainstem is common (Cazier 1997).

The Idaho springsnail is conical with a narrow and tall shell that is 5 to 7 mm high. The Idaho springsnail deposits a single egg in an egg sac on the shells of conspecifics (Lysne 2003a). After hatching, the emergent snails are 0.6 mm in size (Lysne 2003a). They are believed to inhabit cold, well-oxygenated water with low turbidity, and they associate with mud and sand to gravel or boulder-sized substrates (Lysne 2003a).

4.4 Habitat Requirements

All four species of snails require permanent, flowing, freshwater environments to survive and reproduce, with the exception of Utah valvata, which is able to reproduce in reservoir habitats. Some species may be found in river and reservoir habitats, whereas others are restricted to spring habitats. Most species are thought to be detritivore and/or algavore grazers (Pennak 1989).

Utah valvata are usually found in lower velocity habitats of free-flowing river, spring habitat, or reservoirs (USFWS 1995; Weigel 2002, 2003). They are typically associated with fine sediments (<0.25 mm diameter) or gravels mixed with fines. The species is absent from boulder and bedrock substrates (Weigel 2003). Laboratory sediment selection experiments found a preference for pebble size substrates (Lysne 2003a). Laboratory temperature tolerance experiments found that temperatures above 30 °C were lethal, and temperatures below 7 °C caused the snails to become inactive (Lysne 2003a). Significant mortality occurs when the snails are dried; however, they appear to tolerate dewatering if conditions are damp (Lysne 2003a).

The Snake River physa is thought to use the undersides of larger sediments, primarily boulders, in swift currents. This species is thought to only utilize deeper, large river habitat in or adjacent to swift currents (USFWS 1995).

The Bliss Rapids snail occurs on cobble and boulder size substrates in flowing waters of unimpounded reaches of the mainstem Snake River and in a few tributary spring habitats (USFWS 1995). The snail is generally not associated with fine sediments (Cazier 1997, 2002) and normally avoids surfaces with attached plants (Hershler et al. 1994).

The Idaho springsnail is found in riverine or reservoir habitats on the mainstem Snake River (USFWS 1995) and the Bruneau River arm of C.J. Strike Reservoir (Cazier 2002). Sediment selection experiments conducted in the laboratory did not identify a sediment size that was preferred by the species (Lysne 2003a). Temperature tolerance experiments found that temperatures above 30 °C were lethal, and below 9 °C caused the snails to become inactive (Lysne 2003a). Significant mortality occurs when the snails are dried; however, they appear to tolerate dewatering if conditions are damp (Lysne 2003a).

4.5 Factors Contributing to Species Decline

The USFWS (2004) describes how various factors have adversely affected the free-flowing, cold water environments where the listed Snake River snail species have existed for many years. The following human activities have adversely modified habitat and have contributed to deteriorated water quality:

- Hydroelectric development, operations, and maintenance.
- Water withdrawal and diversions.
- Point and non-point source water pollution.
- Inadequate regulatory mechanisms (which have failed to provide protection to habitats).
- Adverse effects associated with non-native species.

4.5.1 Dams and Water Operations

Development of water impoundments and hydroelectric dams has changed the fundamental character of the Snake River (USFWS 2004). Dams have reduced the number of river miles containing free-flowing large-river habitat on the Snake River, and this has fragmented the previously continuous river habitat. Dams have also affected fluvial dynamics and contributed to water quality degradation (USFWS 2004). The dams also have the potential to create physical barriers that may prevent colonies of snails from interacting with one another and recolonizing habitat after a disturbance. Fragmented habitat has isolated extant snails into smaller subpopulations, which are now more vulnerable to extirpation from stochastic events and the other factors listed above (USFWS 2004).

Water operations and storage associated with irrigation projects alter the natural flow regimes of the river. Some aspects of river impoundment appear to be favorable to Utah valvata (Weigel 2002, 2003).

4.5.2 Water Quality

The USFWS (1995) identified cold, clean water as a habitat requirement for the listed snails. State of Idaho water quality standards for cold water biota establish dissolved oxygen concentrations of 6 mg/L or greater and water temperatures of 22 °C or less with a maximum daily average of no greater than 19 °C. Their habitat requirements and evidence from field surveys indicate that several species of the listed snails prefer colder temperatures, more swiftly flowing water, and higher dissolved oxygen than allowed for in the cold water biota standards (EPA 2002).

Snails are generally intolerant of organic enrichment pollution (Lathrop and Markowitz 1995) and are more sensitive to metal exposure (Johnson et al. 1993) than other macroinvertebrate taxa commonly used as environmental indicators (Lysne 2003a). River impoundment, agriculture, aquaculture, and urbanization have affected water quality in the middle and upper Snake River (IDEQ 1998). The middle Snake River is currently listed as water quality limited under section 303(d) of the Clean Water Act for dissolved oxygen, nutrients, oil and grease, and sediment (IDEQ 1998).

Water quality problems are influenced by flow reductions and changes in thermal regime. Water quality degradation comes from inputs of nutrients, sediment, metals, pesticides, and other toxics. Waste from feedlots and dairies, hatchery and municipal sewage effluent, agricultural runoff, and other point and non-point discharges have the potential to affect the Snake River. During the irrigation season, 13 perennial streams and multiple agricultural surface drains contribute irrigation return flow to the Snake River between Shoshone Falls (RM 614.8) and Lower Salmon Falls (RM 573), as well effluent from more than 140 fish culture facilities, and municipal sewage discharge (IDHW 1991). Dairies and feedlots are now required to have zero discharge from their facilities. However, waste management results in manure being spread on agricultural lands and becoming inseparable from other nutrient sources. These factors, coupled with periodic drought-induced low flows, have contributed to reduced dissolved oxygen levels and increased plant growth. Further, the biological oxygen demand during decomposition from the annual decay of the increased plant growth may reduce dissolved oxygen.

Temperature, dissolved oxygen, and physical habitat changes may be detrimental to the snails’ survival, reproduction, and diversity.

4.5.3 New Zealand Mudsnail

The non-native New Zealand mudsnail (*Potamopyrgus antipodarum*) has invaded the Snake River mainstem habitat occupied by the threatened and endangered native snails. The New Zealand mudsnail was first discovered in the middle Snake River in 1987 (Bowler 1991). The mudsnail has rapidly expanded its distribution throughout the United States in the last ten years with populations detected in California, Colorado, Montana, Washington, and Wyoming (USGS 2003). The mudsnail has greater thermal tolerances, growth rates, and fecundity than the native Snake River snails (Richards et al. 2001). Also, this species is parthenogenic (reproduces asexually) and is believed to be able to pass unharmed through the digestive tracts of some fish and wildlife.

Community level change has been detected in study areas where the mudsnail has invaded (Bowler 1991; Hall 2001; Hall et al. 2002). Some studies suggest that there are competitive interactions between the mudsnail and the native species of snails (Richards et al. 2001; Lysne 2003a). The decline of a native snail (*Pyrgulopsis* sp.) was documented during the rapid population growth of the non-native mudsnail (Gustafson 2001). The New Zealand mudsnail has become the most dominant species in the middle Snake River, representing as much as 80 percent of the macroinvertebrate community (EPA 2002). At these densities, the other macroinvertebrate taxa likely experience crowding and increased competition for resources such as mayflies, stoneflies, and caddisflies, which are favorable for supporting a functional aquatic community (Cada 2001).

4.6 Current Conditions in the Action Areas

4.6.1 Dams and Water Operations

Dam building and historical water operations and irrigation activities have contributed to the discontinuous distribution of aquatic snails in the Snake River. Because water is stored and delivered for irrigation, river flows and reservoirs have large seasonal fluctuations. Seasonally high river flows are not considered detrimental to native aquatic species, as these would have occurred naturally and are essential to create and maintain riverine habitats. However, low flows and year-round regulated flows could limit habitat suitability, water quality, and habitat connectivity.

In general, water operations have altered the natural hydrograph by reducing the spring peak flows, increasing summertime flows, reducing the river’s connection to the floodplain, and reducing wintertime low flows. Flood control operations in some years cause increased late winter flows that are reduced before the spring runoff.

Aquifer recharge from surface irrigation applications and a wet climatic period caused water levels in the Snake River Plain aquifer to reach an all-time high in the early 1950s. Since then, groundwater levels have shown a net decline, primarily from increased groundwater pumping for irrigation and increased water conservation by upstream irrigators. These factors, combined with drought, have caused a dramatic decline in the groundwater level and subsequently, spring discharge rates, particularly in the Thousand Springs reach of the Snake River. The listed snails, particularly the Bliss Rapids Snail, rely heavily on spring-influenced reaches of the Snake River for their existence.

Historically, portions of the action areas were dewatered during water storage or delivery. Reaches of dewatered river occurred on the South Fork Snake River, Snake River downstream from Jackson Lake, in the Blackfoot area, and downstream from Milner Dam. Water operations above Miler Dam in the last decade have maintained some streamflow in the river during most conditions. Chapter 3 summarizes hydrologic conditions in the action areas.

The known distribution of listed aquatic snails ranges from the Henrys Fork at the Idaho Highway 33 bridge (Henrys Fork RM 9) near Rexburg downstream to Brownlee Reservoir. This is the area of analysis for the listed snails covered in this biological assessment. Several streamflow gages monitor river flows on both the Snake River and the Henrys Fork.

Lower Henrys Fork

The Henrys Fork near Rexburg gage is immediately downstream from the Idaho Highway 33 bridge. It has a 95-year period of record. The maximum recorded flow was 79,000 cfs in June 1976 (immediately following the Teton Dam failure). Excluding 1976, the maximum recorded daily flow was 16,400 on May 17, 1984. The lowest recorded daily flow was 183 cfs between March 24 and March 28, 1934. Flows at this site are influenced by the operations of a powerplant near Ashton, Henrys Lake, Island Park Reservoir, and Grassy Lake Dam. A considerable volume of water seeps into the Snake River Plain Aquifer upstream from this point.

Gustafson (2004) has conducted extensive invertebrate sampling (approximately 242 sites) in the Henrys Fork. Gustafson (2004) considers Utah valvata to be very rare in the drainage, having found them only at the Highway 33 bridge site. Further, Gustafson (2004) considers this to be an unnatural range expansion due to the warming and siltation of the Henrys Fork in this area.

Snake River from Henrys Fork Confluence to above American Falls Reservoir

The Snake River near Idaho Falls gage is the first gage downstream from the Henrys Fork confluence with the Snake River. This gage has a period of record from October

Table 4-3. Average mean monthly streamflows (cfs) at the Snake River near Idaho Falls and Snake River at Neeley gages for the period from 1987 to 2002.

Month	Henrys Fork near Idaho Falls	Snake River at Neeley
January	3,454	3,033
February	4,204	3,193
March	5,413	4,456
April	6,691	7,539
May	11,100	11,428
June	13,120	14,778
July	8,312	12,374
August	6,220	11,039
September	4,921	7,678
October	3,422	3,333
November	3,568	1,560
December	3,321	2,196

1987 through September 2002. The highest and lowest mean monthly streamflows recorded at this gage during this period are 35,400 cfs in June 1997 and 1,711 cfs in February 2002. Minimum flows typically occur between December and March at this site, and peak streamflows occur between May and August (see Table 4-3).

A November 2003 USFWS survey on the Snake River near RM 780 (near Firth, Idaho) found 7 live Utah valvata and 157 Utah valvata shells (USFWS 2003). All Utah valvata were found at depths greater than 2 feet and were generally associated with fine substrates (USFWS 2003). Relative to Reclamation monitoring sites (flowing sites) below American Falls Reservoir (Weigel 2002, 2003), very low densities of Utah valvata have been detected in the Snake River downstream from the confluence with the Henrys Fork (USFWS 2003). Little is known about the abundance, distribution, and habitat of this population.

American Falls Reservoir

Utah valvata are known to exist in American Falls Reservoir (Weigel 2003). Reclamation initiated random Utah valvata surveys in the reservoir in 2002, sampling a total of 178 sites at depths ranging from 0.9 to 16.1 meter between June 7 and June 14, 2002 (see Figure 4-2). A total of 461 live Utah valvata were collected from 37 0.25 m^2 plots (Weigel 2003). During the collection period, American Falls Reservoir elevation ranged from 4,343.5 feet on June 7 to 4,341.8 feet on June 14 (10.5 to 12.2 feet below the full pool elevation of 4,354 feet). Figure 4-3 (see page 68) shows the snail collection sites with depth data.

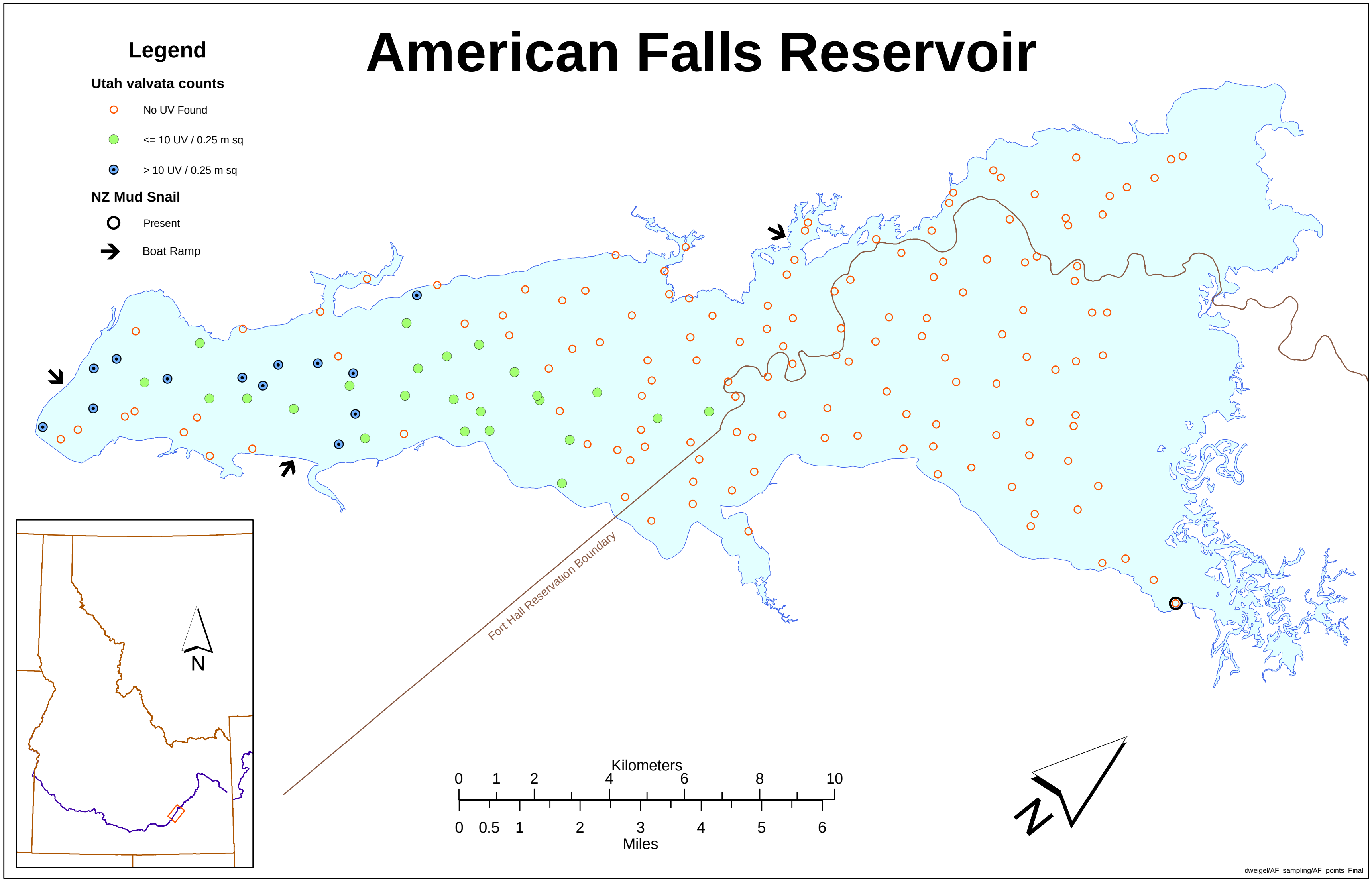

Figure 4-2. Reclamation's 2002 randomly located snail survey locations (Weigel 2003).

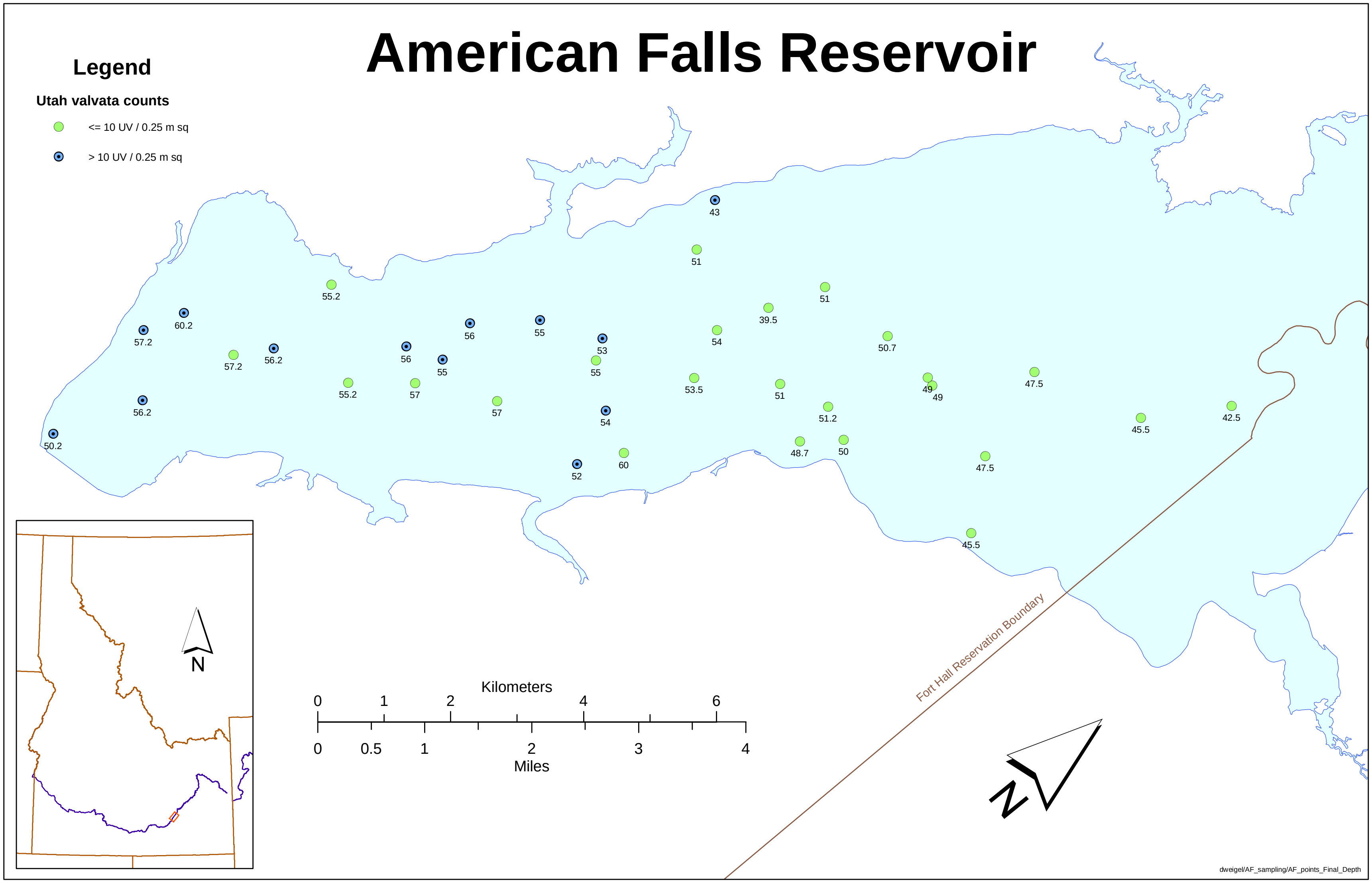

Figure 4-3. Utah valvata locations from Reclamation's 2002 American Falls Reservoir snail surveys. The numbers at each point indicate the depth (in feet) at that point from full pool elevation (Weigel 2003).

In 2003, Reclamation established transects in lower American Falls Reservoir for the 2003 snail survey and future monitoring. Transects were located based on 2002 snail locations and depths. Four randomly selected transects were surveyed, two on May 9 and two on August 4, yielding 20 and 105 live Utah valvata, respectively. No live Utah valvata or Utah valvata shells were found at points at or above the water line. American Falls Reservoir water surface elevations at time of sample were 4,347.5 feet on May 9 and 4,318.4 feet on August 4.

The size, location, and high probability of refill of American Falls Reservoir make it an important reservoir to supply irrigation water in the upper Snake River system, resulting in annual drawdowns. The reservoir usually reaches the lowest pool elevation in late September or early October. The total drawdown from full pool elevation between 1985 and 2003 ranged from 16 feet in 1998 to 57 feet in 1990. The average minimum elevation is 4,314 feet (40 feet below the full pool elevation of 4,354 feet), which was exceeded 68 percent of the time during these years. Only 6 of the 37 Utah valvata colonies identified in the 2002 survey would have been watered in September 1990 (see Figure 4-3).

The reservoir becomes full between March and July, and the surface elevation gradually declines through the spring and summer months. If American Falls Reservoir fills, it usually only remains at full pool for a short time (less than one month) before water withdrawals reduce the surface elevation. This operation prevents much of the reservoir from providing suitable, permanently watered habitat for aquatic snails and other mollusks.

Live Utah valvata have been detected in the lower half of American Falls Reservoir, but they were usually only detected at depths that remained watered more than 95 percent of the time (below elevation 4,311 feet). Mean density at these depths in 2002 was 49.6 snails per m^2 (Weigel 2003). Samples were collected at and above the waterline in 2002 and 2003, with no live Utah valvata or Utah valvata shells being encountered. It is assumed that Reclamation's past and current water operations prevent Utah valvata from occupying much of the reservoir.

The impacts of past and current water operations to Utah valvata in American Falls Reservoir depend on previous years' water elevations. The reservoir is operated for irrigation storage only, and annual drawdown is inevitable. The magnitude and duration of spring runoff, spring precipitation, irrigation season precipitation, and irrigation demands determine the drawdown's degree and duration. During wet periods, when the reservoir is not drawn down to lower levels, Utah valvata likely expand into the available habitat below a given year's minimum pool elevation. Dry periods following wet periods result in the dewatering of the habitat occupied by Utah valvata during the wet period expansion. Varying levels of Utah valvata mortality likely occur during periods of declining annual minimum pool elevations. The magnitude of this mortality is unknown. Bathymetry data and corresponding Utah valvata habitat data are not available for the reservoir, and Utah valvata expansion rates into available habitat are unknown. Therefore, correlations between the annual minimum water surface elevation, recolonization, and mortality are unknown.

Snake River from American Falls Dam to Upper Lake Walcott

The Snake River at Neeley gage (RM 713.5) is approximately 0.5 mile downstream from American Falls Dam (RM 714) and 1 mile upstream from known Utah valvata colonies. From 1987 to 2002, the maximum and minimum mean monthly river flows at this gage were 35,580 cfs in June 1997 and 306 cfs in March 1993. Minimum streamflows in this reach typically occur between November and February, and peak flows typically occur between May and August (see Table 4-3 on page 66).

During Reclamation surveys for Utah valvata colonies in this reach (RM 708 to 711), Weigel (2002) found moderate to high (up to 134 live snails per 0.25 m^2) densities of Utah valvata. Some level of seasonal mortality likely occurred as a result of past fluctuations in river flows, although it is not exactly understood how Utah valvata respond to fluctuating water levels in this reach. However, it appears that Utah valvata do not move with receding waters. As water levels fluctuate, portions of the reach dry rapidly (due to climate and exposure) while subsurface recharge and bank seepage help others remain moist. Lysne (2003a) reported 50 percent mortality for Utah valvata exposed to a dry treatment for 50 hours in a controlled setting, and no mortality in either the wet or moist treatments; therefore, 100 percent Utah valvata mortality is assumed when Utah valvata are left stranded for four days in segments where no bank seepage occurs.

To assess Utah valvata mortality at a known population, Reclamation surveyed dewatered shoreline along the Snake River downstream from Neeley (RM 711) (Weigel 2002). Figure 4-5 on page 76 shows these transects. Discharge was measured at the USGS Neeley river gage station (RM 713.5). As part of normal water operations, discharge was reduced in two steps from 7,991 to 4,957 cfs from September 6 to 13, 2001, and from 4,702 to 370 cfs from October 6 to 16, 2001. During these reductions in flow, gage height changed an average of 0.03 meter per day and 0.08 meter per day, respectively. Between September 13 and October 6, average daily discharge fluctuated between 4,400 and 5,500 cfs.

Fourteen 0.25 m^2 plots were surveyed on October 26, 27, and 30, 2001, 12 days after the last downramping. At each location, one plot was sampled less than 3.0 meters from the water edge, and one plot was sampled more than 3.0 meters from the water edge. Four locations (8 plots) were sampled on the south shore, and three locations (6 plots) were sampled on the north shore (Weigel 2002). Plots were visually selected to be representative of the shoreline and sediment sizes available (Weigel 2002).

Live Utah valvata were more abundant at the plots sampled on the south shore (average 51 and 64 live snails per 0.25 m^2 less than 3.0 meters and more than 3.0 meters from water line, respectively) than on the north shore (average 11 and 16 live snails per 0.25 m^2 less than 3.0 meters and more than 3.0 meters from water line, respectively) (Weigel 2002). The north bank is slightly steeper, and results in less dewatered shoreline. Snails were about equally abundant at sites greater than and less than 3.0 meters from the water's edge 12 days following reductions in flow. The high numbers of snails (up to 134 live snails per 0.25 m^2 on the south shore and 32 per 0.25 m^2 on the north shore) at plots farther from the current water's edge indicates that the snails may not be moving with the receding water level at the ramping rates implemented during 2001 (Weigel 2002). During the time of the shoreline survey, flow was approximately 360 cfs; however, most of this shoreline was still wet due to substrate and bank seepage. These conditions extend the survival of Utah valvata on the dewatered shorelines; however, shoreline survival during freezing winter temperatures is unlikely.

In November 2002, Reclamation estimated linear meters of dewatered Utah valvata habitat at four transects in the Neeley Reach when flows were 350 cfs. Transects began in the middle of the river and extended to the high water line. Transect lengths ranged from 22.2 to 67.7 meters, and the percent of occupied Utah valvata habitat that was exposed at a flow of 350 cfs ranged from 23 to 50 percent (see Table 4-4). Reclamation estimated that 2 percent of the sampled snails occupied the dewatered habitat in 2002 (Weigel 2003).

Table 4-4. Summary data for 2002 Utah valvata snail habitat at the Neeley Reach (RM 711).

Transect	Meters of Transect Occupied (m)	Occupied Habitat Dewatered (m)	Occupied Habitat Dewatered (percent)
4 North	22.2	11.2	50
4 South	67.7	16.2	24
5 South	55.8	12.9	23
6 South	30.5	7.7	25

Snails were collected in September when flows were near 7,000 cfs. Dewatered habitat was measured November 2, 2002, when flows were 350 cfs.

Winter flows in the river downstream from American Falls Dam vary with precipitation and water storage remaining in the reservoirs at the end of the irrigation season. Precipitation during the several water years preceding the fall of 2001 were average or above average. Therefore, winter flows were higher in this reach during these years. In 2001, the winter flow was reduced to 350 cfs for the first time since 1995. It is likely that the snails had dispersed into the later dewatered habitat near the shoreline when flows were higher and the habitat was available. Therefore, the flow reduction in 2001 likely resulted in higher numbers of stranded snails. However, the population utilizing this habitat likely was reduced during 2001 and did not have an opportunity to redisperse into this habitat by 2002, resulting in lower levels of mortality (2 percent mortality) in the subsequent low water year.

Due to the shape of the canyon and river channel, the habitat typically occupied by Utah valvata in this reach (fines to small gravel with fines) starts to become exposed during flows less than 5,500 cfs, which occur approximately 6 months out of every year. During some average and all non-flood operation years, discharge between November and March is below 5,500 cfs. However, during many wet years, especially during those when Reclamation exercises flood control operations at American Falls Dam, minimum annual discharge has usually been greater than 5,500 cfs. Using an operations simulation, Weigel (2002) predicted that December flows would be less than 5,500 cfs 58 percent of the time, and less than 2,000 cfs 35 percent of the time.

Reclamation conducted Snake River physa surveys in 2001 between upper Lake Walcott and American Falls Dam (Weigel 2002). Several Physa sp. were preserved and sent to Amy Worthington at the University of Alabama, Tuscaloosa, for verification. All snails preserved during this survey period were identified as *Physa gyrina*, a physid snail broadly distributed in North America. Live *P. natricina* were not collected during this survey.

Lake Walcott

Reservoir operations at Lake Walcott are consistent and driven by structural limitations at the Minidoka Dam spillway (USBR 2004). The reservoir is drawn down 5 feet annually during the winter and refilled to full pool (elevation 4,245 feet) in April. Reclamation maintains a full pool during the spring and summer to provide irrigation water into the canals on each side of the dam and to maximize the efficiency of the generators. The annual, consistent drawdown of Lake Walcott results in relatively stable year-to-year habitat availability. In the 0- to 2-meter water depth sampling stratum, live Utah valvata densities ranged from 0 to 7 snails per 0.25 m^2, with most snails being found at depths greater than 5 feet (Weigel 2002). For example, in October 2001 at the Lower Lake Walcott survey site, Utah valvata densities were 0 snails per 0.25 m^2 in the 0- to 2-meter sampling stratum and 107 snails per 0.25 m^2 in the 2- to 8-meter sampling stratum (Weigel 2002). Weigel (2002, 2003) more completely describes Utah valvata zonal distribution in Lake Walcott.

Stranding of live Utah valvata in Lake Walcott is approximately 1 percent of the individuals detected during Reclamation monitoring collections (Weigel 2003). This low rate of stranding indicates that Utah valvata may be able to avoid stranding during slower rates of water level changes, or low densities of Utah valvata in this depth stratum could be due to preference for deeper habitats or avoidance of this habitat due to physical and biological alterations related to the annual dewatering.

Snake River below Minidoka Dam

During the summer, Minidoka Dam passes about 10,000 cfs for downstream users. Any water that does not go through the powerplant is released over the dam's spillway structure. Currently, an average of 1,300 to 1,900 cfs is released over the spillway structure during the irrigation season, which extends from April through September. Water is released along the spillway structure in several ways. About 250 cfs leaks through the base of the stoplogs along the entire length. In addition, stoplogs are pulled out of certain bays to release water into established channels. In the middle of the spillway structure, three radial gates provide the greatest control of water releases. Summer water releases over the spillway occur as mitigation for the construction of the Inman Powerplant at Minidoka Dam in 1991 and 1992. Reclamation (2004) describes these releases.

In the winter, the radial gates are the only path for water releases from the spillway structure because the reservoir is drawn down 5 feet to an elevation below the base of the stoplogs. Water passed through the powerplants does not reach the downstream spillway area. In dry winters, no water is spilled through the radial gates, and the spillway dries up with the exception of a few small pools. In wet winters the powerplants alone sometimes cannot accommodate all of the flow, and the radial gates release some water; however, the rest of the spillway still remains dry.

Few snail samples have been collected in the spillway below Minidoka Dam. In June 2000, Reclamation conducted random sampling in the spillway (Weigel unpublished, Minidoka Spillway). Fifty samples were collected with live Utah valvata being found at 2 locations and empty shells being found at 20 locations (see Figure 4-4 on page 75). Random surveys were again conducted in the spillway in July 2004. Twenty-one samples were collected with Utah valvata shells being found at 4 locations. No live Utah valvata were found in 2004 (Newman unpublished). It is likely that Utah valvata disperse into the spillway area below Minidoka Dam during the irrigation season. However, with the annual de-watering of the spillway, it is unlikely that any resident listed snail colonies persist year-round in the spillway area.

Flows in the approximately 7.5-mile stretch of river from Minidoka Dam downstream to Milner Pool fluctuate annually; however, they are relatively constant compared to other reaches of the river. Few listed snails have been documented in this reach. Utah valvata were documented between Minidoka Dam (RM 674.5) and the Jackson Bridge (RM 669.7) in 1996 and 1997 (Ralston 1997, 1998). Reclamation conducted monthly snail surveys in 2000 from August through October between Minidoka Dam and Jackson Bridge (Weigel 2002). Two 2-mile river sections were selected and eight transects were placed within the reach (seven random transects and one overlapping previously identified Utah valvata locations; see Figure 4-5 on page 76). No listed snails were identified. Reclamation repeated the survey in 2001 and again, no listed snails were identified (Weigel 2002).

Keebaugh (2004) reviewed curated samples collected below Minidoka Dam in 1996 by a Reclamation consultant (see Table 4-2 on page 60). Research personnel at Albertsons College, Caldwell, Idaho, have identified the snails as potentially being Snake River physa. The specimens will be verified in the fall of 2004 by nationally recognized experts. It is not known how Reclamation's past operations have affected the Snake River physa.

Milner Dam Downstream to above Brownlee Reservoir

Downstream from Minidoka Dam, private dams alter the water operations, water quality, and river habitat. These dams include Milner Dam and the Idaho Power dams (Idaho Power's Mid-Snake Projects, C.J. Strike, and Swan Falls Dams) that are subject to ESA consultation through the Federal Energy Regulatory Commission (FERC) relicensing process. The Idaho Power dams are operated to optimize power generation and meet customer demand. Irrigation activities store or remove much of the surface water in the river upstream from Milner Dam. Streamflow is restored by tributaries, return flows, and springs (including those in the Thousand Springs area). The only Reclamation facilities located below Milner Dam on the Snake River are four pumps located near Marsing, Idaho.

Little snail information exists for the reach beginning immediately below Milner Dam downstream to the first Idaho Power facility. Milner Dam is generally considered to be the lowest control point in Reclamation's O&M in the Snake River system above Milner Dam, and downstream activities are conducted independent of those activities upstream from Milner Dam (USBR 2004). The upstream storage reservoirs do not supply irrigation water to entities that divert water from the Snake River downstream from Milner Dam, and there are no Reclamation reservoirs on the mainstem downstream from Milner Dam (USBR 2004).

The exercise of water rights, including private water rights, above Milner Dam has reduced flow at the dam to zero, though large flows do pass the dam in years of high runoff and when salmon flow augmentation water is delivered.

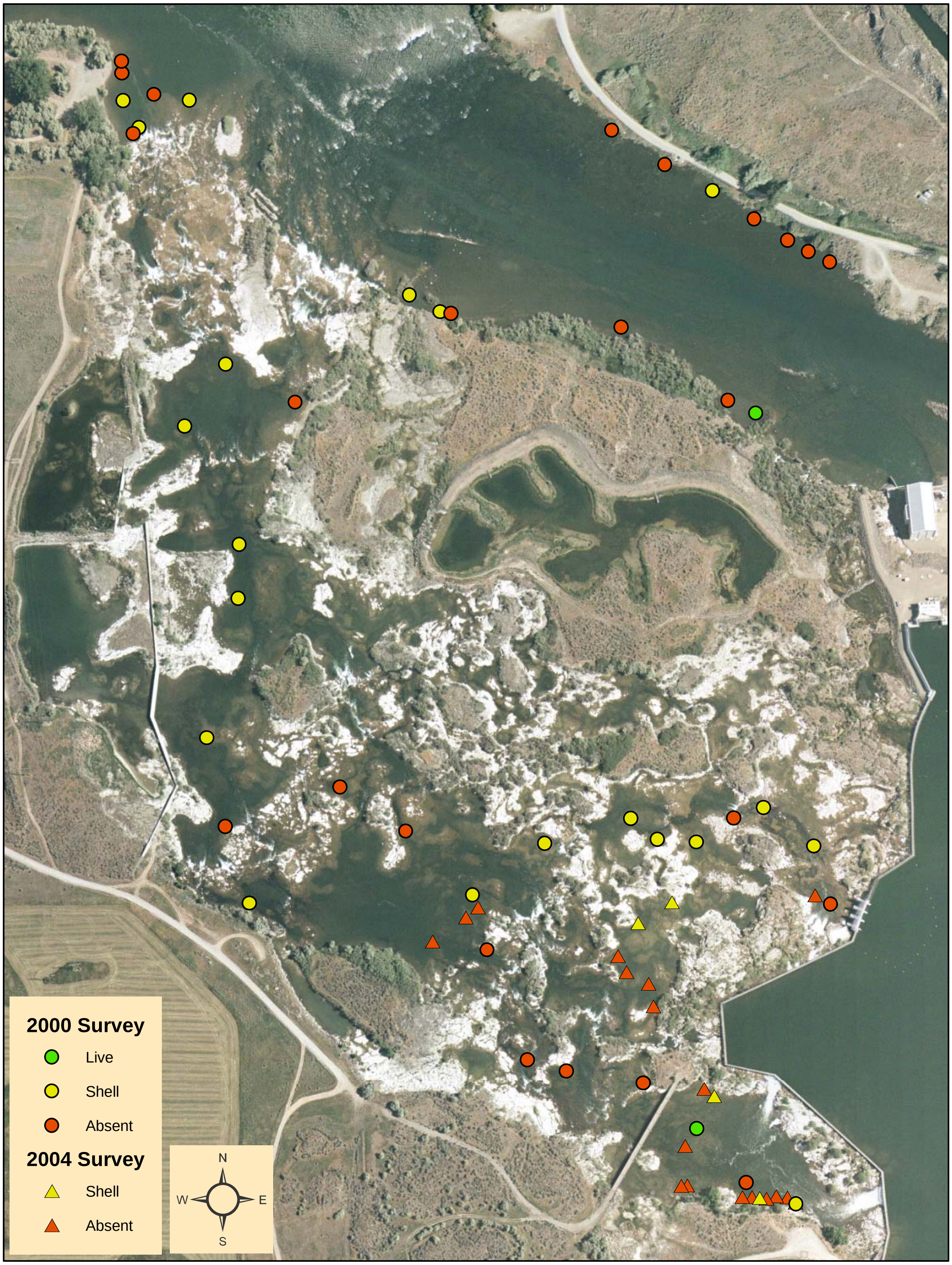

Figure 4-4. Live and empty-shell Utah valvata collections in 2000 and 2004 from the spillway area below Minidoka Dam (Weigel unpublished, Minidoka Spillway; Newman unpublished).

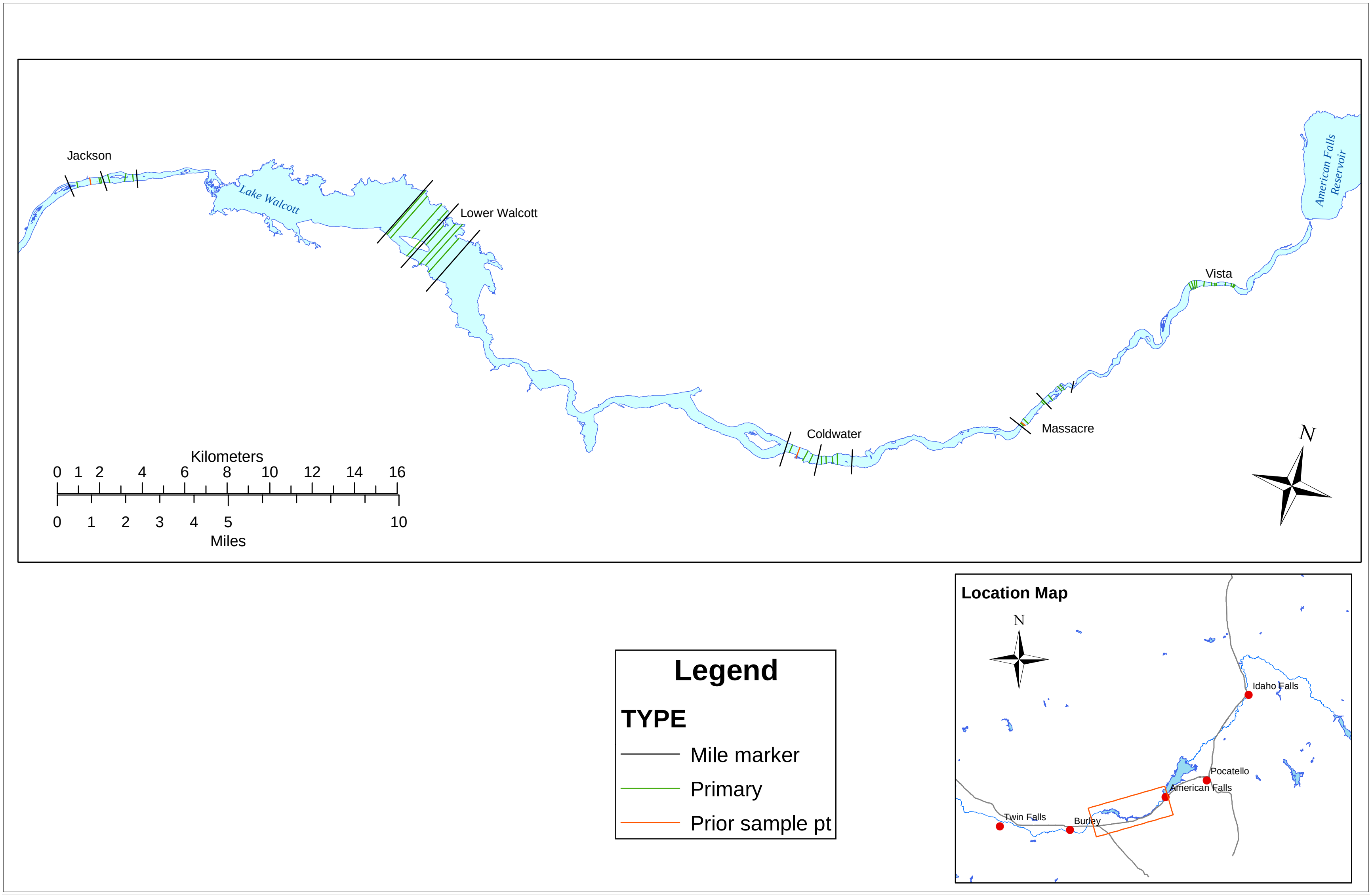

Figure 4-5. Locations of Reclamation's 2000, 2001, and 2002 survey transects from Jackson Bridge upstream to below American Falls Dam (Weigel 2002).

Idaho Power's FERC license requires Idaho Power to maintain, within its capability, a minimum release of 200 cfs immediately downstream from Milner Dam. However, there is no water right for this minimum release, so water must come from natural flow (spill water) between irrigation seasons or from storage or rental pools. This water may not always be available. During the past 95 years, flows have been reduced to between 50 and 0 cfs below Milner Dam 131 times for a period greater than 4 days (when flows below Milner Dam are reduced to, or very near, 0 cfs, the Snake River at Milner gage sometimes gives falsely inflated readings; many times recorded flows up to 50 cfs are false readings). Discharge of the Snake River Plain Aquifer from Bancroft Springs (RM 553) upstream to Briggs Springs (RM 590.5) provides most of the inflow to the Snake River in the reach from Milner Dam to King Hill.

All four species of listed snails covered under this consultation occur in the reach from Milner Dam to Brownlee Reservoir. Reclamation does not conduct annual snail surveys in this reach. However, Reclamation did conduct a small snail survey adjacent to the pumps near Marsing, Idaho, on September 28, 2004, prior to a proposed construction project. No listed snails were found (Weigel unpublished, Marsing Survey).

Utah valvata are known to exist in this reach in Upper Salmon Falls Reservoir approximately one mile upstream from the dam (USFWS 2004), in Thousand Springs (Frest and Johannes 1992), and in Box Canyon Springs (Taylor 1985). The population in Upper Salmon Falls Reservoir is the only population identified below Milner Dam on the Snake River. The other two populations are located in adjacent springs and are therefore excluded from this analysis. The target recovery area for this species extends downstream to RM 572. Idaho Power aquatic biologists routinely survey and monitor the Utah valvata in this area (Cazier 1997).

Below Milner Dam, the Idaho springsnail occurs from the upper end of Brownlee Reservoir at Cobb Rapids (RM 339.3) upstream to the Bancroft Springs area (Cazier 2002) (see Figure 4-1 on page 58). Idaho Power aquatic biologists routinely monitor the Idaho springsnail in this reach and have found densities ranging from 0 to 1,460 snails per m^2 (Cazier 2001a, 2001b, 2001c, 2002).

The Bliss Rapids snail is discontinuously distributed below Milner Dam and is associated with spring tributaries between Clover Creek (RM 547) and Twin Falls (RM 610.5) (USFWS 2004). Relative to the adjacent spring colonies, lower densities of Bliss Rapids snails are found in the mainstem Snake River (USFWS 2004). The presence of these snails in the mainstem is likely due to spring influence (Hershler et al. 1994). Idaho Power aquatic biologists routinely monitor the Bliss Rapids snail in the Snake River from Clover Creek to Twin Falls.

The Snake River physa is thought to occur from Grandview (RM 487) to the Hagerman reach (RM 573); however, recent suspected but unverified findings below Minidoka Dam, as discussed earlier, indicate it may be located farther upstream. The designated target recovery area for this species is from RM 553 to RM 675. Very little is known about this species and its status, but it appears to be very limited in its range and has always been rare (USFWS 2004). The only known, verified collections of the species occurred between 1959 and 1985, with live specimens coming from the Hagerman Reach, downstream from Lower Salmon Falls Dam (Taylor 1988).

4.6.2 Pumps and Diversions

In addition to the larger structures described above, numerous pumps and diversions affect flows and habitat in the action areas. The past effects of these diversions on the four species of listed snails are unknown. Collectively, the reduction of flow does reduce the amount of snail habitat available; however, this change has not been quantified. In addition, reductions in flow can be generally related to reductions in water quality. This, too, has not been quantified. However, it should be noted that Reclamation's actions result in higher flow conditions in the Snake River during the summer months than would have likely existed historically.

Very little is known regarding snail entrainment. Currently, it is not known specifically how the four listed species disperse, outside of physical movement across the substrate. Some species of snail disperse by clinging to water surface tension and drifting or by simply altering their specific gravity and drifting (Pennak 1989). In addition, snail eggs or juveniles that become dislodged from the substrate may disperse by drifting in the water column. It is possible for listed snail adults, juveniles, and eggs to become entrained in water diversion structures on the Snake River. However, without knowing the dispersal mechanism, dispersal rates, and dispersing snail concentrations per unit volume of water, it is not possible to make any inferences regarding snail entrainment under current conditions.

4.6.3 Water Quality

The effects of construction and past and current operation of dams and diversions on the upper Snake River include a series of changes in the physical conditions upstream and downstream from the structures, particularly modifications to the temperature regime, water quality, and clarity. For example, irrigation return water is the largest contributor of sediments to the Snake River (USFWS 2004). It is estimated that over 300,000 pounds of soil are washed into the Snake River daily, during the irrigation season (EPA 2002). Water quality changes may be slight or considerable, depending upon water residence time in the reservoirs and whether surface or deep water is released. These depend on whether Reclamation is implementing flood operations, delivering irrigation water, or both. The modified physical and chemical conditions have resulted in changes to plant and animal life of the river.

Changes to water quality resulting from reduced flows generally affect concentrations of pollutants in the downstream reach. A reduction in flow will not add pollutants but may result in higher concentrations of pollutants in the flow-reduced reach. Flow reduction tends to increase the effect of pollutant inputs. Flow reduction may also have an effect on the temperature of water in the reach. Generally, the effect would be an increase in temperature when flow is reduced, but depending on the channel shape and velocity, temperature could also decrease or remain the same with flow reduction.

Although studies have not been conducted to determine the tolerance of the listed Snake River snails to reduced water quality, inferences can be made from the current known distribution and abundance of these snails (USFWS 2004). Both the Idaho springsnail and the Utah valvata appear to be at least somewhat tolerant of elevated water temperatures and sediment-laden habitats (USFWS 2004). By contrast, the Bliss Rapids snail is largely restricted to cold, well-oxygenated waters with rock or cobble substrates; it is absent or found in reduced numbers in the warmer waters of the Snake River. Very little is known about the Snake River physa, but it is assumed to be reliant on good water quality and found in deeper portions of the mainstem Snake River on stable, rock substrates. Water temperature and dissolved oxygen are believed to be far more restrictive and limiting for the Bliss Rapids snail and the Snake River physa (USFWS 2004).

The current distribution of snails is likely a result of the interaction between water operations, water quality, and river hydrology creating suitable environments. However, much of the available water quality data cannot be directly correlated with listed snail distribution and abundance in a quantifiable manner. Water quality information provided here is intended to describe the current water quality conditions.

Various agencies monitor water quality in the Snake River's upper and middle reaches. These data are usually collected at designated monitoring sites at weekly or biweekly time intervals. Although these water quality data cannot be directly correlated with the presence and abundance of listed snails, they are useful to describe the general trends and conditions in various reaches within the area of analysis.

State of Idaho water quality criteria for waters designated as supporting cold water aquatic life are dissolved oxygen concentrations exceeding 6 mg/L at all times and water temperatures of 22 °C or less with a maximum daily average of no greater than 19 °C. In lakes and reservoirs, the dissolved oxygen minimum concentration does not apply to the bottom 20 percent of water depth when depths are less than 35 meters or the bottom 7 meters of water where depths are greater than 35 meters (IAC 2004).

Snake River from the Confluence with the Henrys Fork to American Falls Reservoir

In 2000 and 2001, the USGS conducted temperature monitoring at two existing gage sites, the Snake River near Shelley and the Snake River near Blackfoot, from May to September. At the Shelley site, temperatures ranged from 7.2 to 21.8 °C in 2000 and from 7.7 to 24.3 °C in 2001. At the Blackfoot site, temperatures ranged from 7.9 to 23.1 °C in 2000 and from 9.3 to 23.5 °C in 2001. Maximum temperatures exceeded 20.0 °C at both sites in 2000 beginning in July and at both sites again in 2001 from June until the end of data collection.

The USGS, in cooperation with the IDEQ, tested water quality at four sites on the Snake River downstream from Idaho Falls for a four-year period. The sites were near Shelley, Firth, Blackfoot, and Ferry Butte (Tilden Bridge). All sites were sampled biweekly April to September in the years 2000 through 2003. The IDEQ found that nutrients did not appear to exceed current recommended EPA nutrient criteria in this section of the Snake River. Average total phosphorus did not exceed 0.035 mg/L, which is well below the EPA guidance of 0.050 mg/L for rivers and streams entering a lake or reservoir. Total suspended solids concentrations in the Snake River immediately upstream from American Falls Reservoir ranged from 0.5 to 79 mg/L at Tilden Bridge and from 0.50 to 30 mg/L at Firth (IDEQ 2003).

The USGS monitored the Snake River as part of their National Water Quality Assessment (NAWQA) program. Much of the NAWQA effort involved testing for pesticides and organic compound contamination in the water, sediment, and fish tissue samples from the upper Snake River. Fish collected from the Snake River near Blackfoot had detectable concentrations of dichlorodiphenyltrichloroethane (DDT) metabolites, polychlorinated biphenyls (PCB), and chlordane. Water tested from sites near Shelley and near Blackfoot was found to contain atrazine and Eptam (or EPTC). However, comparison of fish-tissue data collected during the NAWQA study with data collected during the early 1970s indicates that the bans on use have been effective in reducing the environmental concentrations of organochlorine compounds in the Snake River basin (USGS 1998).

There are limited metals data within the action areas. Reclamation does test for metals in water column samples collected triennially from the reservoirs. These data are of limited use and do not include sediment testing for metals.

American Falls Reservoir

Water column sampling occasionally reveals a specific monitoring location with dissolved oxygen levels below 6.0 mg/L at all tested depths. The IDEQ conducted 38 sampling trips at either a site near Little Hole Draw or near the dam. Three of these 38 trips revealed a water column that had dissolved oxygen levels of less than

6.0 mg/L at all depths, two times at the dam site and one time near Little Hole Draw. Although there are areas with periods of very low dissolved oxygen, they do not occur consistently across the reservoir. Total phosphorus concentrations in the reservoir are often above the 1986 EPA suggested levels for lakes and reservoirs (IDEQ 2003). Reclamation and the IDEQ water quality analysis between 1995 to 2003 show that total phosphorus levels were consistently above the 1986 EPA recommended level of 0.025 mg/L for reservoirs.

Shoreline erosion has been a concern since the reservoir was constructed. Reclamation performs shoreline maintenance each summer, including leveling and grading cliffs and covering exposed soil with riprap or vegetation to reduce erosion and sediment inputs into the reservoir. The extent that shoreline erosion affects concentrations of suspended solids and turbidity in the reservoir is not known.

While American Falls Reservoir maintains relatively large storage content, the Total Suspended Solids (TSS) and Turbidity measurements of the outflow measured at the Snake River at Neeley gage parallels the measurements of the Snake River inflow measured at Tilden Bridge. However, an increase in TSS and Turbidity concentrations occurs as the water moves through the reservoir. This occurs because tributary inflows often have higher sediment loads than the river, bank erosion contributes sediment to the reservoir, and there may be small exportation of stored sediment from the reservoir. Further, Aeolian (wind) deposits may be the largest input of sediment into the reservoir. The American Falls region topsoil consists of mostly windblown Loess material. When the wind blows heavily in the area, which occurs often, dust and sand are moved in enormous quantities with the wind. An unquantifiable volume of this sediment is deposited in the reservoir and could account for increases in turbidity as water moves downstream through the reservoir. This total increase is usually less than 20 Nephelometer Turbidity Units (NTUs), which is within the IDEQ limits for waters supporting cold water aquatic life.

As the reservoir is drawn down, the relationship between upstream and downstream sediment concentrations dissipates as sediment begins to be exported from the reservoir at higher rates. Higher rates of sediment exportation appears to begin at water storage levels in the range of 2 to 4 percent (approximately 33,000 to 67,000 acre-feet), depending on the year. Although four years of data have been collected, a good relationship between storage content and sediment exportation has not yet been found. Some of the other factors involved in sediment exportation rates include:

- reservoir inflow and outflow
- rate of inflow or outflow change
- rate of drawdown

- wind action (causing Aeolian deposition of sediment within the river and reservoir)
- earlier (including previous years) water operations
- water carryover within the reservoir

Data will continue to be collected during years that storage content is expected to drop below 5 percent, or 83,500 acre-feet. This water quality issue is in the river reach downstream from the reservoir, not in the reservoir itself. Since 1960, American Falls Reservoir has been drawn down below 2 percent of capacity (33,000 acre-feet) 7 times.

American Falls Dam to Milner Dam

Table 4-5 summarizes the water quality monitoring data for this reach.

The TMDL for the Lake Walcott Subbasin lists instream water quality targets for the Snake River from immediately below American Falls Dam downstream to Milner Dam. The target total suspended solid concentration is a monthly average of 25 mg/L with a daily maximum of 40 mg/L from American Falls Dam to Milner Dam. Dissolved oxygen concentrations are required to exceed 6 mg/L from American Falls Dam to the Burley/Heyburn Bridge and to exceed 5 mg/L from the bridge

Table 4-5. Water quality monitoring data collected from American Falls Dam to Milner Dam.

Collection Site [1]	Average	Standard Deviation	Minimum	Maximum
Neeley Pipeline downstream from American Falls Dam (RM 711)				
Summer Temperature (°C)	18.8 [2]		11.2	23.2
Dissolved Oxygen (mg/L)			1.7	15.1
Total Suspended Sediment (mg/L)	10	14	1	107
Total Phosphorus (mg/L)	0.079	0.041	0.023	0.217
Jackson Bridge downstream from Minidoka Dam (RM 673)				
Summer Temperature (°C)	20.0 [2]		14.2	24.3
Dissolved Oxygen (mg/L)			1.7	15.8
Total Suspended Sediment (mg/L)	9	7	1	60
Total Phosphorus (mg/L)	0.061	0.027	0.022	0.212
Milner Dam (RM 638)				
Summer Temperature (°C)	20.8 [2]		14.0	28.9
Dissolved Oxygen (mg/L)			5.4	14.6
Total Suspended Sediment (mg/L)	13	7	1	39
Total Phosphorus (mg/L)	0.111	0.067	0.038	0.450

1 Samples were collected bi-weekly from October 1995 to September 2003. All data, except average temperature, represent yearly data. See USBR (unpublished) for the source data.

2 Average summer temperature is calculated using data collected between June and August.

downstream to Milner Dam. The total phosphorus concentration target is a yearly average of 0.080 mg/L with a maximum of 0.128 mg/L from Minidoka Dam to Milner Dam. There is no total phosphorus target upstream from Minidoka Dam (IDEQ 1999).

The Walcott TMDL suspended solid concentration target is typically exceeded only when American Falls Reservoir is drawn down to below 5 percent of capacity (elevation 4,306 feet). When summertime dissolved oxygen concentrations are low in American Falls Reservoir, Idaho Power's FERC license for their project at American Falls Dam requires them to inject air into the water at the hydropower generators. Therefore, summertime dissolved oxygen concentrations have been greater than 6 mg/L at the Utah valvata colonies in the river downstream from American Falls Dam (Weigel 2003). Lake Walcott typically stays within the water quality standards for cold water biota (Weigel 2003).

There is insufficient data to quantitatively correlate low water levels in American Falls Reservoir with dissolved oxygen concentrations. However, the relationship between American Falls Reservoir water levels and mean residence time should be noted. For example, when American Falls Reservoir is drawn down to 50,000 acre-feet (3 percent of total capacity) and irrigation releases are 8,000 cfs (a common irrigation release), mean residence time is approximately 3 days. This reduces the water quality effects associated with impoundment.

During the summer, periods of reduced dissolved oxygen occur in Lake Walcott. In most instances, the variation of dissolved oxygen in the water column is minimal (difference of 2.0 mg/L between the surface and reservoir bottom). On occasion, reservoir bottom dissolved oxygen concentrations near the powerplant are below 2.0 mg/L.

The average total phosphorus concentration of Minidoka Dam discharge (as measured at Jackson Bridge) between 1995 and 2003 was 0.061 mg/L, which is a 23 percent decrease from the average total phosphorus concentration upstream at the Neeley site (downstream from American Falls Dam). Nutrient uptake by plant growth in Lake Walcott likely reduces the total phosphorus.

Average total suspended solids also decrease between the Neeley and Jackson Bridge sites (upstream and downstream from Lake Walcott). Average suspended solids concentrations drop by 10 percent (from 10 to 9 mg/L) in this reach. Solids settling out of the water column in Lake Walcott likely reduce suspended solids. Both suspended sediment and total phosphorus concentrations increase again before Milner Dam. Irrigation return flows, stormwater drains, and permitted loads from municipalities and industries may contribute to this increase.

The Milner Pool is listed as warm water biota for its designated use. Different numeric criteria for water temperature apply compared to the rest of the Snake River upstream from Milner Dam. Standards for warm water biota require temperatures of 33 ºC or less with a maximum daily average not greater than 29 ºC. All other reaches above Milner Dam have a designated use of cold water biota. Cold water biota standards require water temperatures of 22 ºC with a maximum daily average of no greater than 19 ºC.

Milner Dam to above Brownlee Reservoir

The reach of the Snake River downstream from Milner Dam is characterized by high nutrient concentrations and extensive growth of aquatic vegetation. A recent ecological risk assessment identified that high water temperatures, low flows, and sedimentation are the major stressors thought to be responsible for the decline in the native species of snails in this reach (EPA 2002). The assessment study recommended that adverse conditions can be improved if a spring freshet is reestablished with flows suitable to provide temperatures for fish reproduction and development. Table 4-6 summarizes water quality monitoring for sites in this river reach.

Between the sample dates of October 18, 1999, to December 27, 1999, the middle Snake River did not meet the state dissolved oxygen standards of 6.0 mg/L for cold

Table 4-6. Water quality monitoring data collected downstream from Milner Dam.

Collection Site [1]	Average	Standard Deviation	Minimum	Maximum
Blue Lakes Bridge (RM 612)				
Summer Temperature (°C)	20.4 [2]		15.4	24.3
Dissolved Oxygen (mg/L)			5.9	14.8
Total Suspended Sediment (mg/L)	17.5	11.5	1	91
Total Phosphorus (mg/L)	0.091	0.036	0.042	0.260
Clear Lakes Bridge (RM 594)				
Summer Temperature (°C)	17.6 [2]		8.6	22.3
Dissolved Oxygen (mg/L)			5.8	14.1
Total Suspended Sediment (mg/L)	25	20	4	120
Total Phosphorus (mg/L)	0.118	0.031	0.055	0.214
Bliss Bridge (RM 566)				
Summer Temperature (°C)	18.7 [2]		16.0	21.5
Dissolved Oxygen (mg/L)			6.2	13.3
Total Suspended Sediment (mg/L)	22.0	17.94	4	153
Total Phosphorus (mg/L)	0.097	0.024	0.060	0.232

1 Samples were collected bi-weekly from May 1995 to March 2001. All data, except average temperature, represent yearly data. See USBR (unpublished) for the source data.

2 Average summer temperature is calculated using data collected between June and August.

water biota. During this time, samples collected from the river between American Falls Reservoir and the Bliss reach showed dissolved oxygen concentrations below 6.0 mg/L for several consecutive sampling events at most sites. The cause is possibly due to die-off and subsequent decomposition of aquatic plants. However, over the 5-year monitoring period, this was the only time dissolved oxygen concentrations were recorded below 6.0 mg/L.

Total phosphorus in flowing water can be used as an index of the degree of eutrophication and nuisance plant growth. The Upper Snake Rock Creek TMDL established an instream total phosphorus target of 0.075 mg/L for the middle Snake River. From 1995 to 2000, all of the monitoring sites in this area showed elevated phosphorus concentrations characteristic of a eutrophic system. In the upper reaches of the middle Snake River (Milner Dam downstream to Blue Lakes Bridge) approximately 60 percent of the total samples collected exceeded the concentration of 0.075 mg/L. At Clear Lakes Bridge, the samples in exceedance of 0.075 mg/L were 93.6 percent with a range of 0.055 to 0.214 mg/L.

4.6.4 New Zealand Mudsnail

Changes in the invertebrate community are due to the above-described alterations in the physical and chemical environment below Reclamation's reservoirs. An overall reduction in habitat heterogeneity likely accounts for a reduction in species diversity and an increased abundance for those species favored by the altered conditions. The non-native New Zealand mudsnail (*Potamopyrgus antipodarum*) has invaded the Snake River mainstem habitat occupied by the threatened and endangered native snails. It has a high reproductive potential and can attain extremely high densities when introduced into a system. In addition, the mudsnail has a seemingly inverse relationship to water velocity and has greater thermal tolerances, growth rates, and fecundity than the native Snake River snails (Richards et al. 2001). The mudsnail is likely to continue to compete with resident snail fauna.

Mudsnail densities are increasing and expanding throughout the Snake River basin above Brownlee Reservoir. Mudsnails are documented in extremely high densities in free-flowing environments (Richards et al. 2001; Gustofson 2001) but appear to be less numerous in reservoir environments (Weigel 2002, 2003). It is not clear whether these lower densities are a result of the habitat or the ability of the species to disperse into this area.

Mudsnails were collected at only one site in the upstream end of American Falls Reservoir during a survey in 2002 (Weigel 2003). However, mudsnail densities in the river downstream from American Falls Reservoir are moderately high, exceeding 600 mudsnails per m^2 (Weigel 2002). Since 1997, mudsnails have steadily increased in Lake Walcott from 12.7 mudsnails per m^2 in 1997 (Irizarry 1999) to 80 mudsnails per m^2 in 2002 (Weigel 2003). Densities of New Zealand mudsnails in the middle Snake River near Banbury Springs are greater than 4,000 individuals per m^2 (Shinn 2001).

4.6.5 Urbanization

Multiple communities exist along the Snake River in the action areas. The communities affect the Snake River in a variety of ways. As adjacent lands give way to urban development, impacts to the Snake River increase. Waterfront property owners typically construct erosion barriers (i.e., rip rap, concrete water walls, etc.) and maintain manicured lawns, eliminating the riparian area and the habitat associated with the riparian/litoral region interface. Manicured lawns also increase the potential for nutrification through the application of lawn fertilizers.

Urbanization also requires sewage treatment. Septic systems, urban runoff, and sewage treatment plant discharge all contribute to declining water quality in the Snake River. There are several urban centers (Idaho Falls, Rexburg, Pocatello, Blackfoot, American Falls, Burley/Heyburn, and the Twin Falls area) located on the Snake River that collectively contribute large volumes of wastewater to the river. The Twin Falls sewage treatment plant alone can treat 7.8 million gallons per day of wastewater, which contributes nutrients, ammonia, suspended and settleable solids, and organic matter (EPA 2002).

4.7 Effects Analysis

The areas of analysis vary by species. The following subsections identify river reaches and reservoirs where the associated proposed actions may have a hydrologic influence. The effects discussion for each reach includes a discussion of a particular species only if that reach is within the species' area of analysis. Section 4.8 summarizes Reclamation's determination for each proposed action. The specific areas of analyses by species are:

- For the Utah valvata, the Henrys Fork from RM 9.3 to its mouth, and the Snake River from its confluence with the Henrys Fork (RM 832.4) downstream to Hagerman (near RM 572) (this is within the action area for future O&M in the Snake River system above Milner Dam and future provision of salmon flow augmentation from the rental or acquisition of natural flow rights).
- For the Snake River physa, the Snake River from American Falls Dam (RM 714) downstream to Grandview (RM 487) (this is within the action areas for future O&M in the Snake River system above Milner Dam, future

operations in the Little Wood River system, and future provision of salmon flow augmentation from the rental or acquisition of natural flow rights).

- For the Bliss Rapids snail, the Snake River from Twin Falls (RM 610.5) downstream to Clover Creek (RM 547) (this is within the action areas for future O&M in the Snake River system above Milner Dam, future operations in the Little Wood River system, and future provision of salmon flow augmentation from the rental or acquisition of natural flow rights).
- For the Idaho springsnail, the Snake River from Bancroft Springs (RM 553) downstream to Cobb Rapids at the upper end of Brownlee Reservoir (RM 339) (this is within the action areas for future O&M in the Snake River system above Milner Dam; future operations in the Little Wood River system; future O&M in the Owyhee, Boise, Payette, and Malheur River systems; and future provision of salmon flow augmentation from the rental or acquisition of natural flow rights).

The future O&M in the Snake River system above Milner Dam will continue to include Reclamation's operation of the reservoirs in the upper Snake River above Milner Dam as a unified storage system; water will be stored and released to maximize the capability of the storage reservoirs. This means that water will be physically stored in those reservoirs that are most difficult to fill (most often as far upstream as possible, regardless of storage right priorities) and will be released from the reservoirs that are most likely to refill the following year.

At any given time, reservoir storage and flows in various reaches of the upper Snake River above Milner Dam will vary depending upon several factors. These factors include the amount of precipitation in the previous year as well as in the past few weeks or days, reservoir carryover at the end of the storage season, air temperature, and irrigation demand. Reservoir content and streamflows at any instant provide limited information on the system operation as these could markedly differ in a few weeks or even a few days. River flows may even change greatly in a few hours. However, graphs of river flows and reservoir contents can provide a general overview of the range of possible operations. The tables in Appendix D summarize the estimated range of hydrologic conditions under the proposed actions. Appendix E provides more complete hydrologic conditions data. All modeled flows incorporate salmon augmentation water.

For the snails analyses, Reclamation chose to separate the upper Snake River into distinct segments based on operations, available data, potential impacts from the proposed actions, and the occurrence of snail populations. The distinct Snake River segments are: above American Falls Reservoir, American Falls Reservoir to above Lake Walcott, Lake Walcott to Milner Dam, Milner Dam to Shoshone Falls, and Shoshone Falls to above Brownlee Reservoir.

Although operational effects below Milner Dam may not be as direct as they are above Milner Dam, Reclamation's operations do affect the Snake River below Milner Dam. The analysis below Milner Dam was separated into two reaches based on localized impacts. Immediately below Milner Dam, future O&M in the Snake River system above Milner Dam is partially responsible for occasionally dewatering the Snake River through the storage and diversion of project water. Between Milner Dam and Shoshone Falls, limited spring input adds water to the channel.

From Shoshone Falls to above Brownlee Reservoir, combined effects associated with the proposed actions become increasingly difficult to distinguish from other localized factors. In this reach, river flows are increased via spring recharge, localized runoff, irrigation return flows, and municipal and industrial effluent. Water quality is also altered by urbanization, effluent from dairies, fish culture facilities, and irrigation returns. Any potential effects resulting from Reclamation's proposed actions become further attenuated by Idaho Power's localized operations.

Snail entrainment as a result of the proposed actions is difficult to assess. As described in Section 4.6.2, little is known regarding snail entrainment, and an accurate effects analysis is not possible. It is likely that entrainment does occur at diversions located below snail colonies; however, the timing and magnitude of entrainment, if it even occurs, is not known. Very little information exists regarding gastropod entrainment in the literature.

Reclamation does not know the effects, if any, of water quality on the listed snails in the action areas. No data has been collected or encountered that describes or quantifies the relationship between the listed snails and any single or suite of water quality constituents.

4.7.1 Snake River and the Henrys Fork above American Falls Reservoir

Aquatic snails in this river reach are in the action area for future O&M in the Snake River system above Milner Dam.

Reclamation (2004) describes the operation of numerous upper Snake River facilities. Grassy Lake Dam, Island Park Dam, and discharge from the Teton River and other tributaries to the Henrys Fork below Island Park Dam control flows in the lower Henrys Fork. Jackson Lake, Palisades Reservoir, and Ririe Reservoir also influence hydrologic conditions in this reach.

Utah valvata

The lower Henrys Fork and the Snake River from its confluence with the Henrys Fork downstream to American Falls Reservoir have populations of Utah valvata. A USFWS survey near Firth, Idaho, found 7 Utah valvata in the river channel at depths below 2 feet (USFWS 2003). Other information at these sites is limited; however, it is likely that the Utah valvata is unable to persist in river fluctuation zones near the shoreline. The few locations where Utah valvata persist are likely permanently watered habitats. As occurs in other locations monitored by Reclamation, Utah valvata likely annually disperse into available habitat during high flow periods. When flows are reduced following irrigations season, the dispersed snails may become stranded as the water recedes to the minimum winter flow. Because too little information is available for this site, it is only possible to draw general conclusions regarding Utah valvata mortality.

Reclamation is currently conducting a joint investigation with the Idaho Department of Fish and Game (IDFG), the Bureau of Land Management (BLM), and the Idaho Department of Transportation. Approximately 15 to 20 sites will be surveyed for snails on the Snake River above American Falls Reservoir to below Palisades Dam and on the Henrys Fork up to Henrys Lake. This information will be made available as soon as all sample identification work is complete; this will likely occur by February 2005.

Although Utah valvata have been documented in the Snake River above American Falls Reservoir and the lower Henrys Fork, little is known about their distribution, abundance, or population trends. In addition, nothing is known about the relationship between river discharge and Utah valvata population and habitat sustainability in this reach. Operations at Island Park and Grassy Lake Dams have little impact to the overall annual flow regime of the lower Henrys Fork where Utah valvata are found (specifically, near the Idaho Highway 33 bridge near Rexburg, Idaho).

Annual flow fluctuations from Jackson Lake and Palisades Reservoir, combined with the minor influence from Henrys Fork storage facilities, will affect Utah valvata in the Snake River above American Falls Reservoir; however, impacts to the species are currently unquantified. It is likely that snail mortality does occur in this reach as a result of Reclamation's annual water level fluctuation.

Future O&M in the Snake River system above Milner Dam will result in Utah valvata mortality above American Falls Reservoir. Data collected by the USFWS in 2003 indicate that Reclamation's proposed action precludes the snail from occupying littoral reaches of the Snake River. This would continue to occur under the proposed action.

4.7.2 Snake River from American Falls Reservoir to above Lake Walcott

Aquatic snails in this river reach are in the action area for future O&M in the Snake River system above Milner Dam.

Reclamation (2004) describes the operation of American Falls Dam. Reclamation tries to maintain 50,000 to 60,000 acre-feet in the reservoir but may drain it during low water years (when American Falls Reservoir is drawn down to less than 50,000 acre-feet, the detention time of water moving through the reservoir can be less than 3 days; at these times, the reach behaves more similarly to a river than a reservoir as the majority of the surface area of the reservoir has receded into the original Snake River channel). American Falls Reservoir has no designated “inactive” or “dead” storage. However, it should be noted that a 100 percent drawdown of American Falls Reservoir is not possible through Reclamation actions alone.

The reservoir fluctuates greatly from year to year with hydrologic conditions. Reclamation will maintain an overwinter flow of approximately 350 cfs to maintain water quality downstream from the dam even in years when the reservoir pool is very low at the end of the irrigation season. If inflows are higher than expected or if carryover storage is substantial, winter releases may range from 1,000 to 5,000 cfs. During flood operations, flows as high as 42,000 cfs are possible.

Utah Valvata

Water operations directly affect aquatic snails through shoreline stranding and by altering or reducing the quality and availability of the habitat (Christman et al. 1996). Low flows prevent snails from colonizing shoreline habitats; however, when flows are restored, snails can re-disperse over time into these shoreline habitats (Christman et al. 1996). Snail populations likely expand and contract as precipitation levels expand or contract the reservoir contents and river flows. It is likely that successive years of above-average precipitation and runoff will result in expansion of the snail populations, while a dry year following one or two wet years will result in higher levels of mortality (relative to the level of mortality in a low water year following successive low water years). Similarly, successive dry years (below-average precipitation and runoff) will result in lower levels of mortality.

Minimum annual water surface elevations for American Falls Reservoir may fluctuate from 4,296 to 4,345 feet. The shoreline areas that are annually dewatered will have minimal numbers of snails (less than 1 percent). Most of the Utah valvata population is found at and below elevation 4,311.4 feet. When American Falls Reservoir drafts to an elevation of 4,311.4 feet, it is at 7 percent total capacity. Nearly all Utah valvata locations identified by Weigel (2002) were at or below this elevation. It should be noted, however, that American Falls Reservoir was drafted to an elevation of 4,311 feet in September 2000. The data collected by Reclamation from 2001 to 2003 were collected during extreme drought conditions (potentially worse than the 1930s), therefore representing extreme conditions and fluctuations for the system.

Mortality is most likely to occur when the water surface elevation drops below 4,311.4 feet. The model predicts these deeper water areas will be watered approximately 74 percent of the time (see Figure 4-9 on page 94). Figure 4-6 displays the modeled summary hydrograph for the range of reservoir water surface elevations in the proposed action. However, because the model uses a monthly time step, there may be occasions when the monthly average elevation will be above 4,311.4 feet in months the reservoir water surface elevation drops below this elevation for short periods of time. Using historical daily data for the 79-year period of record, American Falls Reservoir was drafted below 4,311.4 feet for at least 4 days in 29 out of the 79 years (about 37 percent of years). Lysne (2003a) reported 50-percent mortality for Utah valvata exposed to a dry treatment for 50 hours in a controlled study. Although actual dessication rates may vary, dependent upon factors such as weather conditions, ambient temperature, and substrate compositions, snail mortality at 96 hours (4 days) would be near 100 percent. The proposed action will have less severe impacts to Utah valvata than past operations. For example, in 1993,

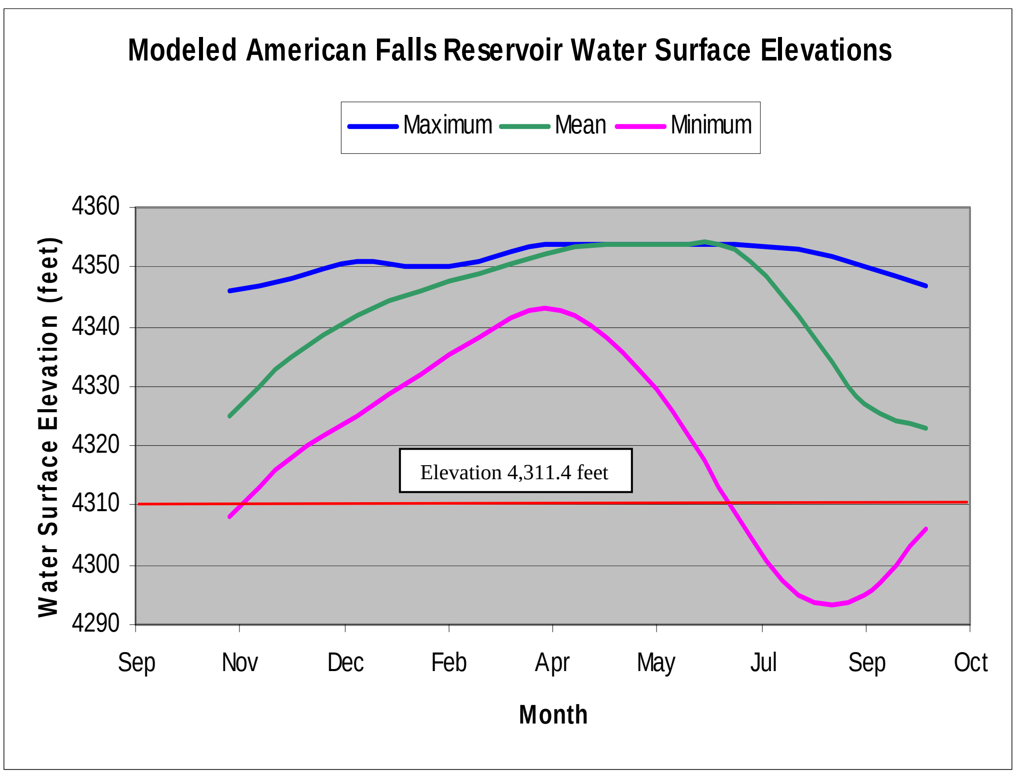

Figure 4-6. Modeled summary hydrograph of American Falls Reservoir water surface elevations under the proposed action (see USBR 2004, Appendix B, for explanation of summary hydrographs).

a relatively wet year, American Falls Reservoir was drafted to an elevation of 4,331 feet in September. Under the proposed action for similar water supply conditions, it is predicted to be drafted to 4,337 feet, an increase in elevation of 6 feet. Likewise, as previously discussed for a dry year, American Falls Reservoir is predicted to be 4 feet higher than actual operations.

The relationship between reservoir fluctuation and Utah valvata population response is unknown. The area of potential snail habitat in the reservoir is not known, nor is the snail recolonization/distribution rate into that habitat when the potential habitat becomes watered. In addition, bank seepage from local irrigation and bank storage produce wetted areas adjacent to the reservoir. Lysne (2003a) reported no mortality for Utah valvata exposed to a moist treatment in a controlled laboratory study; therefore, mortality resulting from desiccation is not anticipated in these wetted areas unless the snails fail to reach watered habitat prior to freezing conditions.

Previous stranding surveys have identified high levels of stranding during the fall flow reductions in the river reach downstream from American Falls Dam; in these areas, few snails appear to move with the receding water (Weigel 2002). However, in the fall of 2002, only 2 percent of the Utah valvata sampled during monitoring activities in this reach occupied the dewatered habitat. Due to the shape of the river channel, it is likely that most snail habitat begins to become exposed when flows drop below 5,500 cfs.

Figure 4-7 displays the modeled summary hydrograph for the range of flow conditions in the proposed action. During most wet years, minimum annual discharge

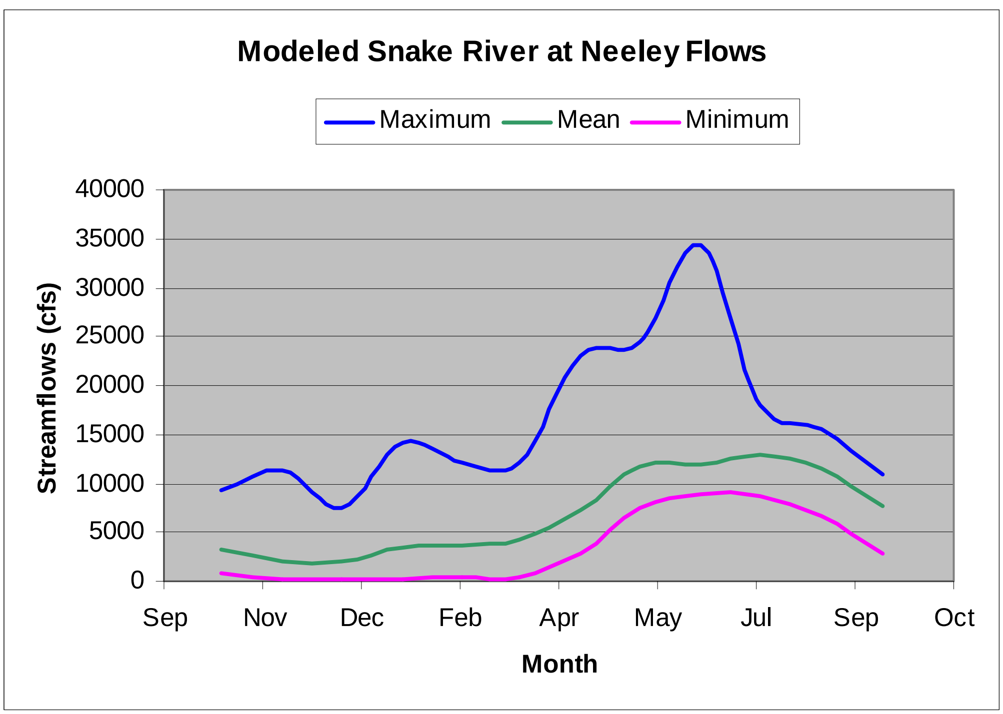

Figure 4-7. Modeled summary hydrograph of streamflows at the Snake River at Neeley gage under the proposed action.

will continue to be greater than 5,500 cfs. The model predicts flows will be above 5,500 cfs approximately 58 percent of the time.

Although not a legal minimum flow, 350 cfs is the target operational minimum for this reach. At flows below 350 cfs, cavitation occurs below the outlet gates in American Falls Dam. This was discovered in 1978, a dry year, when flows were reduced to approximately 200 cfs for two months. Therefore, future flows less than 350 cfs are highly unlikely. Under the proposed action, the monthly mean flow at the Neeley reach below American Falls Reservoir is predicted to be 350 cfs or less in 5 percent of years. Despite this, high levels of mortality are possible during the fall and winter months of a low water year following successive high water years. The proposed action will have similar impacts to Utah valvata as past operations.

Leading into and following irrigation season, Reclamation ramps its flows to meet irrigation demands. Ramping rates are not pre-determined or standard; rather, they are general rates established to ensure the safety of downstream river users. Ramping rates at American Falls Dam are set to not exceed a 0.5-foot-change in river stage per two-hour period. Snail mortality still occurs as few snails appear to move with the receding water.

Again, flow-based habitat availability data are lacking to accurately describe the relationship between discharge from American Falls Reservoir and the area of available Utah valvata habitat. It should be noted that the reach from below American Falls Reservoir to the upper end of Lake Walcott contains the highest densities of New Zealand mudsnails collected during Reclamation snail monitoring activities over the past four years (up to 607 per m^2). No information is available indicating whether or not the New Zealand mudsnail benefits from Reclamation operations.

Future O&M in the Snake River system above Milner Dam will result in Utah valvata mortality in American Falls Reservoir. Research conducted by Reclamation personnel from 2002 to 2003 indicate that the fluctuation of American Falls Reservoir prevents Utah valvata from occupying much of the reservoir. Figure 4-8, on page 94, shows the predicted percentage of Utah valvata habitat exposed, assuming all substrate is Utah valvata habitat, for American Falls Reservoir elevations at or below 4,311 feet. Figure 4-8 is not an empirical predictive model but rather is a general regression between water surface elevation and percent of Utah valvata habitat exposed. It is based on several assumptions. First, it assumes a direct relationship between water surface elevation and Utah valvata habitat. Second, it assumes all of the substrate is Utah valvata habitat. Third, it assumes 100 percent Utah valvata mortality once habitat becomes exposed. One-hundred percent mortality is not possible with water level fluctuation alone since Reclamation cannot completely dewater the reservoir. Figure 4-9, also on page 94, shows the number of years the model predicts American Falls Reservoir would have fallen to a minimum annual water surface elevation over the period of record from 1928 to 2000.

Future O&M in the Snake River system above Milner Dam will cause mortality in the Snake River below American Falls Dam in the Neeley reach. Reclamation's proposed actions will dewater approximately 23 to 50 percent of the Utah valvata habitat available in this reach in any given year. However, mortality will vary with preceding water years. Mortality can be expected to range from 2 to 50 percent in any given year.

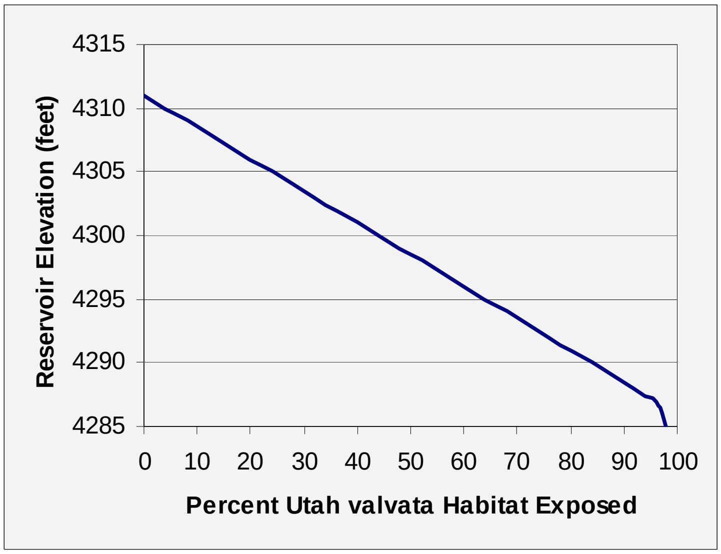

Figure 4-8. Percent of Utah valvata habitat exposed at given American Falls Reservoir elevations, assuming a direct relationship between mortality and water surface elevation.

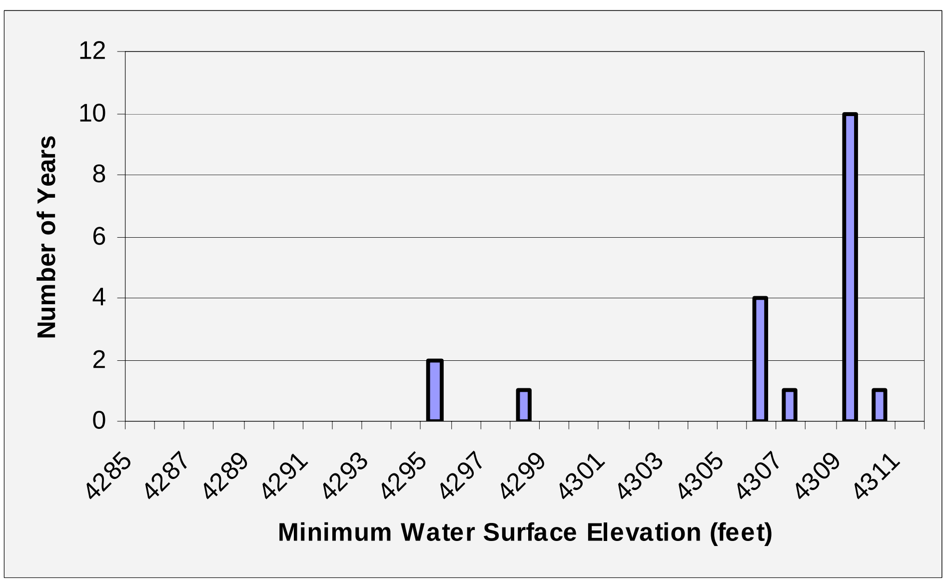

Figure 4-9. Number of years in 72 years that American Falls Reservoir will be drafted to minimum elevation under the proposed actions for water conditions simulating the period of record from 1928 to 2000.

4.7.3 Snake River from Lake Walcott to Milner Dam

Aquatic snails in this river reach are in the action area for future O&M in the Snake River system above Milner Dam.

Reclamation (2004) describes the operation of Minidoka Dam. Lake Walcott is held at full pool (elevation 4,245 feet) during the irrigation season to allow irrigation flows into the Minidoka Northside and Minidoka Southside Canals. Following irrigation season, Lake Walcott is drawn down five feet to elevation 4,240 feet to prevent ice damage to the spillway structures. Under the proposed action, ramping will not take place at Minidoka Dam. Past ramping operations did not benefit Utah valvata, as the snails did not appear to move with the receding water. During dry years, Lake Walcott can be drawn down near the end of irrigation season to provide storage water for irrigation purposes.

During the winter, Minidoka Dam passes inflow that comes from American Falls Reservoir releases and from reach gains (a total of 150 to 250 cfs). Outflow as low as 60 cfs is possible during the spring immediately prior to the irrigation season when Minidoka Dam is being raised to full pool (see Figure 4-10). The channel's shape from Minidoka Dam downstream to Milner Pool keeps much of the channel watered, even during flows below 400 cfs. The model predicts flows this low approximately 9 percent of the time.

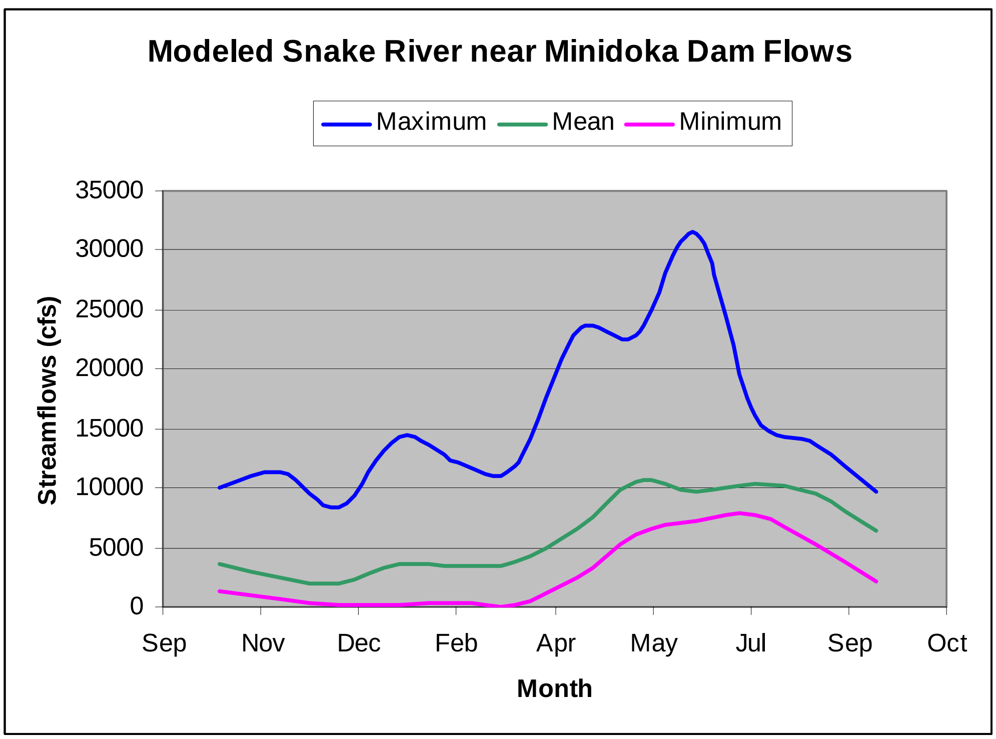

Figure 4-10. Modeled summary hydrograph of streamflows at the Snake River near Minidoka Dam gage under the proposed action. Lowest flows displayed on the hydrograph are 60 cfs in mid-March.

Utah Valvata

The annual drawdown of Lake Walcott prevents Utah valvata from recolonizing the shallower shoreline habitat in the reservoir; this results in little impact to the existing population (Petersen et al. 2000; Weigel 2002, 2003). In Lake Walcott, less than 1 percent of Utah valvata snails sampled during monitoring occupied the reservoir fluctuation zone. Thus, expected stranding will be less than 1 percent of the reservoir's Utah valvata population. The density of stranded Utah valvata in Lake Walcott ranges from 2.0 to 3.5 snails per m^2 in Utah valvata habitat (fines to small gravel with fines) (Weigel 2002, 2003).

Under the proposed action, Utah valvata will likely continue to disperse into the spillway area below Minidoka Dam; this will result in stranding and mortality during the annual dewatering period.

Flows in the 7.5-mile reach from Minidoka Dam downstream to Milner Pool fluctuate annually; however, they are relatively constant compared to other reaches of the river. Few listed snails have been documented in this reach. Utah valvata were documented between Minidoka Dam and the Jackson Bridge in 1996 and 1997 (Ralston 1997, 1998). Reclamation surveyed for snails between Minidoka Dam and Jackson Bridge monthly from August through October in both 2000 and 2001, but no listed snails were identified (Weigel 2002). Little fine sediment habitat existed in the reach between Minidoka Dam and Milner Pool for Utah valvata colonization. This is likely a result of high flows in May and June 1997. However, depositional bars are beginning to occur within this reach; therefore, it is likely that Utah valvata have since recolonized portions of this reach, but no further surveys have been conducted. Fines become more prevalent in upper Milner Pool, but no Utah valvata surveys have been conducted there.

As flows drop below 400 cfs, Utah valvata mortality via stranding will begin to occur. No studies have been conducted in this reach to quantify the relationship between listed snail habitat and flow. However, based on observation at various flows, listed snail habitat starts to become exposed at flows less than 400 cfs below Minidoka Dam downstream to Jackson Bridge. The proposed action does not increase or decrease the frequency or threshold of this occurrence.

Reclamation's actions will result in very low levels of mortality in Lake Walcott. Each year, under the proposed action, less than 1 percent of the Utah valvata population will be lost to stranding.

Future O&M in the Snake River system above Milner Dam will result in Utah valvata mortality in the spillway area below Minidoka Dam following irrigation season each year. This mortality will be very low considering densities of 1 live Utah valvata per 0.25 m^2 were found in 3.3 percent of the samples collected by Reclamation in 2002 and 2004. In the reach from Minidoka Dam downstream to above Milner Pool, Utah valvata mortality will occur when flows are reduced to below 400 cfs. The model predicts this will occur approximately 5 percent of the time.

Snake River Physa

The Snake River from Lake Walcott to Milner Dam does not possess the attributes consistent with Snake River physa habitat requirements. This reach has been generally considered outside of this species range, although it does exist within its designated recovery area (RM 553 to RM 675). Further, no known, verified specimens have ever been identified from this reach. As discussed earlier, Keebaugh (2004) recently discovered 4 suspected alive-when-sampled Snake River physa and 12 empty shells collected by Reclamation consultants in 1996 below Minidoka Dam. If the specimens are verified as Snake River physa after completion of this biological assessment, Reclamation will submit supplemental information.

4.7.4 Snake River from Milner Dam to Shoshone Falls

Aquatic snails in this river reach are in the action area for future O&M in the Snake River system above Milner Dam and provision of salmon flow augmentation from the rental or acquisition of natural flow rights.

Milner Dam is a large irrigation diversion structure with very limited storage capacity. It is privately owned and operated. After flood control operations are complete, typical operation of upstream facilities is to supply only enough water to meet the diversion demands of the canals diverting from the Milner Pool, Idaho Power contract storage, and salmon flow augmentation. Diversions from the Milner Pool have a combined capacity of approximately 11,000 cfs. These diversions consist of Reclamation project water and private natural flow rights.

Idaho Power has a contract for storage water in American Falls Reservoir, and Idaho Power usually orders its storage water at a rate of 230 cfs to meet conditions of its FERC license. Once Idaho Power's contract storage is exhausted and flow augmentation deliveries are complete, flow may be reduced to zero during the irrigation season in some years. The first 230 cfs (approximately) of flow below Milner Dam is directed through Idaho Power's small turbine at the right abutment of the dam's spillway structure and discharges immediately below the dam. The next 5,450 cfs flows through the first 1.6 miles of the Twin Falls South Side Canal to Idaho Power's Milner Hydroelectric Project. Additional flow, above approximately 5,680 cfs, is released through the dam's spillway. Winter flows below Milner Dam consist of water released from Minidoka Dam and local reach gains.

All Idaho Power facilities below Milner Dam are privately owned, and their operations are private actions and not associated with any proposed action, with the exception of its use of its American Falls Reservoir storage water.

Under the proposed action, augmentation flow releases may slightly increase flows past Milner Dam. It is unknown what, if any, effects this increase in flow will have on listed snails in the Snake River between Milner Dam and Shoshone Falls. Listed snail presence would have to be determined before any potential impacts resulting from augmentation flows could be assessed. The proposed action involves modifying the Milner Flow agreement to pass up to 3,000 cfs past Milner Dam when providing flow augmentation (see Chapter 3 for a discussion of this maximum flow and the modeled output). This is an increase from the 1,500-cfs operation in the past, which will result in a shorter release period. Figure 4-11 displays a modeled summary hydrograph of the streamflows under the proposed action for this gage.

Reclamation has not conducted any listed snail surveys downstream from Milner Dam and is not aware of other surveys that have been conducted in this reach; none of the four aquatic snail species are thought to occur there.

Utah Valvata

Although this reach is within the Utah valvata's designated recovery range, the species is not known to occur in the reach from Milner Dam to Shoshone Falls.

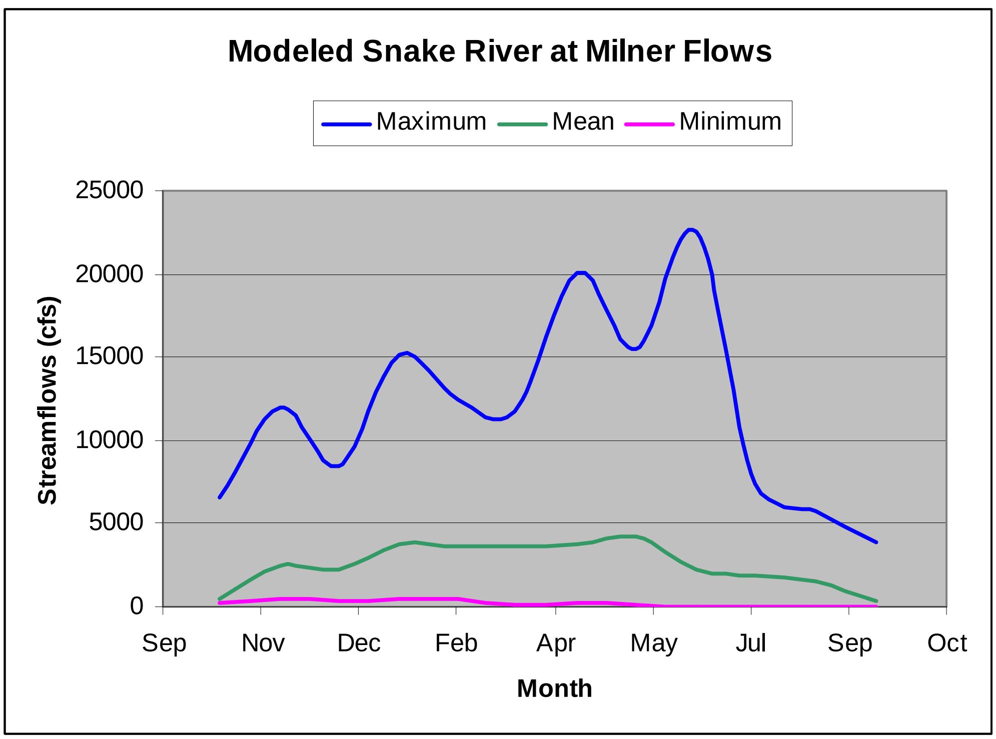

Figure 4-11. Modeled summary hydrograph of streamflows at the Snake River at Milner gage under the proposed action (this gage is below the Idaho Power powerhouse at Milner Dam).

Snake River Physa

Although this reach is within the Snake River physa designated recovery range, the species is not known to occur in the reach from Milner Dam to Shoshone Falls. This reach does, however, possess the attributes consistent with the suspected Snake River physa habitat requirements identified in the literature.

4.7.5 Snake River from Shoshone Falls to above Brownlee Reservoir

Aquatic snails in this reach occur in some or all of the action areas for future O&M in the Snake River system above Milner Dam; future operations in the Little Wood River system; future O&M in the Owyhee, Boise, Payette, and Malheur River systems; and future provision of salmon flow augmentation from the rental or acquisition of natural flow rights. This effects discussion considers the combined effects of those relevant proposed actions.

Reclamation does not own or operate any dam, diversion, or water withdrawal structure in the Snake River from Milner Dam downstream to Brownlee Reservoir with the exception of four pumping stations near Marsing, Idaho. All Idaho Power facilities below Milner Dam are privately owned, and their operations are private actions not associated with the proposed actions. However, Reclamation's storage, release, and diversion of water have hydrologically influenced this area during most average and low water years and will continue to do so.

Idaho Power owns and operates five hydroelectric projects on the middle Snake River: Shoshone Falls, Upper Salmon Falls, Lower Salmon Falls, Bliss, and C.J. Strike. All four of the listed snails covered under this consultation occur in this reach. Idaho Power is subject to consultation through the FERC relicensing process. Idaho Power's operations in this reach directly affect the river operations and habitat.

Under the proposed actions, augmentation flow releases during average to dry water years may slightly increase flows in this reach from current operations. The model predicts an increase from current operations of 147 cfs in minimum annual discharge at the Snake River near Murphy, Idaho. The effects of Reclamation's proposed actions will be attenuated and negligible in this reach of the river. The effects of Reclamation water releases in the past seem to have had a negligible impact on river stage at the Idaho Power facilities below Twin Falls (USBR 1996). An increase in flow augmentation releases from 1,500 cfs to 3,000 cfs will have a negligible impact on listed snails in this reach.

Reclamation is unable to distinguish any likely effects to listed snails attributable to the proposed actions.

Utah Valvata

Utah valvata are known to exist in this reach in Upper Salmon Falls Reservoir approximately one mile upstream from an Idaho Power dam (USFWS 2004). The population in Upper Salmon Falls Reservoir is the only population identified in this reach that occurs in the mainstem Snake River. Flow augmentation releases at Milner Dam will result in less than a 0.5-foot fluctuation at Upper Salmon Falls Reservoir where the snail occurs (see Figure 4-12), it is anticipated that no Utah valvata mortality will be attributable to this change.

Effects from future O&M in the Snake River system above Milner Dam and provision of salmon flow augmentation from the rental or acquisition of natural flow rights to this population of Utah valvata are insignificant relative to Idaho Power's actions and other impacts to the Snake River above this point to Milner Dam. Utah valvata mortality downstream from Milner Pool will not result from the proposed actions.

Snake River Physa

Although very little is known about the distribution, habitat requirements, or status of the Snake River physa, much of its designated recovery range is within this reach, extending downstream to RM 553. Flow augmentation releases at Milner Dam will

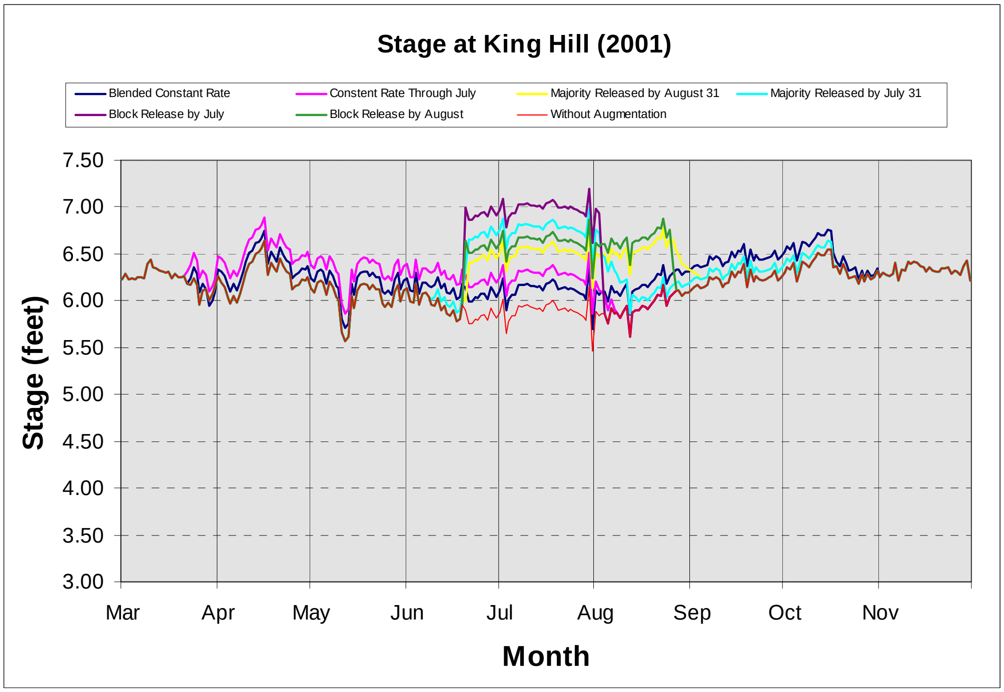

Figure 4-12. Snake River stage at King Hill under various salmon augmentation flow release strategies from Milner Dam. The yellow line most accurately portrays the proposed release strategy for the augmentation water. The red line represents river stage without augmentation.

result in less than a 0.5-foot fluctuation (increase) in river stage at King Hill (RM 546.6) where the snail may occur (RM 487 to RM 573). It is anticipated that no Snake River physa mortality will be attributable to this change.

The effects from future O&M in the Snake River system above Milner Dam, provision of salmon flow augmentation from the rental or acquisition of natural flow rights, and future operations in the Little Wood system become attenuated and insignificant in the reach relative to other local factors. Snake River physa mortality downstream from Milner Pool will not result from the proposed actions.

Bliss Rapids Snail

Although the Bliss Rapids snail is primarily associated with spring tributaries, the snail is found in the mainstem Snake River from RM 547 to RM 585. Flow augmentation releases at Milner Dam will result in less than a 0.5-foot fluctuation (increase) in river stage at King Hill (RM 546.6), which occurs immediately below the Bliss Rapids snails known distribution (RM 547 to RM 610.5). It is anticipated that no Bliss Rapids snail mortality will be attributable to this change.

The effects from future O&M in the Snake River system above Milner Dam, provision of salmon flow augmentation from the rental or acquisition of natural flow rights, and future operations in the Little Wood system become attenuated and insignificant in this reach relative to the direct effects from agricultural inputs, fish farm effluent, dairy effluent, urbanization, spring input, irrigation return flows, tributary input, localized runoff, and Idaho Power operations. Bliss Rapids snail mortality will not result from the proposed actions.

Idaho Springsnail

The Idaho springsnail occurs in this reach from the upper end of Brownlee Reservoir at Cobb Rapids (RM 339.3) upstream to the Bancroft Springs area (RM 553) (Cazier 2002). Idaho Power’s operations and other previously described local impacts that occur in this reach collectively alter the availability and quality of Idaho springsnail habitat in this reach. Flow augmentation releases at Milner Dam will result in less than a 0.5-foot fluctuation (increase) in river stage at King Hill (RM 546.6); this is an increasingly negligible net change in river stage within this reach. Any effects become attenuated with these local factors and become increasingly insignificant relative to local factors in farther downstream reaches. The seven proposed actions will not result in Idaho springsnail mortality.

4.7.6 Cumulative Effects

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the action areas. Future Federal actions that are unrelated to the proposed actions are not considered in this section because they require separate consultation.

A large number of activities occur in the action areas, such as agriculture, aquaculture, sewage treatment, construction, rural and urban development, degradation of waterways and springs, and contaminant spills. Municipal and industrial wastewater returns, agricultural returns, fish farm effluent, and spring input, including the Thousand Springs area and Box Canyon where large volumes of high quality water are input into the Snake River, may affect the listed snails to some degree. These activities will continue to occur into the future, and their effects constitute cumulative effects.

Section 303 of the Clean Water Act requires states and tribes to periodically publish a priority list of impaired waters, currently every two years. For waters identified on this list, states and tribes must develop TMDLs, which are water quality improvement plans that establish allowable pollutant loads set at levels to achieve water quality standards. The State of Idaho has been completing Subbasin Assessments and TMDLs in southern Idaho for some time now. The following TMDLs address the Snake River and many tributaries from the Bingham/Bonneville County Line downstream to King Hill, Idaho:

- Middle Snake River Watershed Management Plan (Total Phosphorus Only) – approved by the EPA in April 1997 (covers 94 miles between Milner Dam and King Hill, Idaho). Pollutant of concern is total phosphorus.
- Upper Snake Rock Watershed Management Plan – approved by the EPA in August 2000 (covers 14 stream segments of the Snake River within the same 94 miles between Milner Dam and King Hill, Idaho). Pollutants of concern are sediment, nutrients (phosphorus and nitrogen), pathogens (fecal coliform bacteria), ammonia, pesticides, and oil and grease.
- Lake Walcott Subbasin Assessment and Total Maximum Daily Loads – approved by the EPA in June 2000 (covers the Snake River between American Falls Dam and Milner Dam). Pollutants of concern are sediment, dissolved oxygen, nutrients, pesticides, and oil and grease.
- American Falls Subbasin Total Maximum Daily Load Plan: Subbasin Assessment and Loading Analysis – Public comment period closed in August 2004 (covers the Snake River from the Bingham/Bonneville County Line to American Falls Dam). Pollutants of concern are sediment, nutrients, bacteria, and dissolved oxygen.

The following TMDLs address the Snake River from King Hill, Idaho, downstream to the confluence of the Salmon River:

- Snake River-King Hill - C.J. Strike Reservoir Watershed: Subbasin Assessment and TMDLs – currently under internal review by the Idaho Department of Environmental Quality (covers the Snake River from King Hill downstream to C.J. Strike Dam). Pollutants of concern are sediment, nutrients, and pesticides.
- Mid Snake River/Succor Creek Subbasin Assessment and Total Maximum Daily Loads – approved by the EPA in January 2004 (covers the Snake River between C.J. Strike Dam downstream to the confluence with the Boise River). Pollutants of concern are nutrients, dissolved oxygen, sediment, temperature, and bacteria.
- Brownlee Reservoir (Weiser Flat) Subbasin Assessment and Total Maximum Daily Loads – approved by the EPA in November 2003 (covers the Snake River between the Weiser River and Brownlee Dam). Pollutants of concern are sediment, nutrients, and temperature.
- Snake River – Hells Canyon Total Maximum Daily Loads – approved by the EPA in September 2004 (covers the Snake River between where it intersects with the Oregon/Idaho border downstream to upstream of the confluence with the Salmon River). Pollutants of concern are bacteria, nutrients, nuisance algae and dissolved oxygen, pesticides, pH, sediment, temperature, and total dissolved gas. A mercury TMDL has been postponed to 2006 due to lack of water column data.

Most of the TMDLs would not be considered fully implemented at this time. TMDLs set timelines for evaluation of attainment, not necessarily attainment due dates. TMDLs and their associated implementation plans are understood to be in effect until attainment of the TMDL and/or beneficial uses are met. In some cases, the maximum daily loads may not be met within the 30 years of this consultation. Implementation, however, should be ongoing for at least the entire 30 years or until the water body no longer appears to be impaired, whichever occurs first. TMDLs do have periodic review schedules in place (usually about every five years) when water quality status will be reevaluated and implementation plans may be updated.

The implementation phase of these TMDLs should result in improved water quality for the Snake River within and downstream from these reaches. Implementation includes numerous activities with the goal of reducing pollutant loads to the established TMDL limits. Although most implementation recommendations are voluntary, individuals and groups have made sincere efforts to improve water quality conditions.

Many canal companies and irrigation districts have taken proactive steps to reduce non-point source sediment and nutrient loading. Two examples of the efforts that these organizations have made are the Twin Falls and North Side Canal Companies. The Twin Falls Canal Company has installed about 120 sediment detention basins over the last 14 years to reduce sediment moving from their systems into the Snake River. The North Side Canal Company has been reducing their return flows, thereby reducing their nutrient and sediment loads to the Snake River. They have achieved nearly a zero discharge back to the Snake River by automating their systems and increasing the reuse of their tailwater. The efforts associated with implementation of the TMDLs have reduced sediment and nutrient loading to the mid-Snake River.

4.8 Effects Conclusion

4.8.1 Future O&M in the Snake River System above Milner Dam

Reclamation has determined that future O&M in the Snake River system above Milner Dam may affect and is likely to adversely affect Utah valvata in the Snake River and Henrys Fork above American Falls Reservoir, in American Falls Reservoir, below American Falls Dam, in Lake Walcott, and below Minidoka Dam.

Adverse effects to Utah valvata in the Snake River above American Falls Dam include unquantified effects due to stranding and mortality from flow fluctuations.

Adverse effects to Utah valvata in American Falls Reservoir include stranding and mortality when the reservoir is drawn down to an elevation lower than successive previous years' elevations. An elevation of 4,311.4 feet should be used as a benchmark. This is expected to occur in 26 percent of years (see Figure 4-9 on page 94) and dewater up to 65 percent of potential habitat (see Figure 4-8 on page 94)

Adverse effects to Utah valvata below American Falls Dam include stranding and mortality, ranging from 2 to 50 percent, when flows begin to drop below 5,500 cfs in 42 percent of years, and then down to 350 cfs in 5 percent of years.

Adverse effects to Utah valvata in Lake Walcott include stranding and mortality of less than 1 percent of the population annually when the reservoir is drawn down at the end of the irrigation season.

Adverse effects to Utah valvata below Minidoka Dam include stranding and mortality in the spillway below the dam during the annual dewatering period, and stranding and mortality when flows in the mainstem Snake River are less than 400 cfs about 5 percent of the time.

4.8.2 Combined Effects of Seven Proposed Actions in the Snake River above Brownlee Reservoir

Reclamation has determined that future O&M in the Snake River system above Milner Dam; future operations in the Little Wood River system; future O&M in the Owyhee, Boise, Payette, and Malheur River systems; and future provision of salmon flow augmentation from the rental or acquisition of natural flow rights may affect but are not likely to adversely affect the Snake River physa, Bliss Rapids snail, and Idaho springsnail.

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